ELECTRICAL WORLD

A consolidation of Electrical World, Electrical Engineer and American Electrician

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What in the World!

Starting with a fresh pack and lively shuffling, the New Deal is rapidly disclosing its aces. The gold rush reversed its direction and, paralleling it, unbounded faith supplanted dismal desperation. Moral restraint is lifted from the citizenry, while new restraints are imposed on banks and security peddlers. Government wages contract to match living cost indexes. Popular confidence, meanwhile, belies all business indicators—sad but true, they are down, again and still.

●

There's a correlation between what is happening in national circles and what is aborning in the autonomous channels of business. Ethical zeal is struggling to assert itself over a multitude of labyrinthine practices—piety trying to retrieve substance wasted in riotous living. While the mood lasts much permanent good will result. Eventually America's resources of materials, money, men and minds will create a glorious new order out of disorder.

●

Too few realize how drastically the new order will differ from the old. Mr. MacNeill, discussing the problems ahead of industry in this issue, shows a splendid appreciation of just that metamorphosis. Brand new approaches to production, to design, to competition, to sales, to customer are seen as inevitable. Shopworn practices will not work.

●

Further envisioning the potpourri of influences which will determine tomorrow's business activities, Mr. Gaskill tells why selling kilowatt-hours is going to be a different job. It can be as hopeless as selling cosmic rays unless the stress be on the virtues of the devices through which kilowatt-hours do their beneficent tasks.

Sodium-vapor lamp street lighting (Philips), Roermond, Holland

APRIL 8, 1933

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Electrical World articles are indexed in Industrial Arts and Engineering indexes, available in public libraries

Published weekly. $5 per year. 25 cents per copy. Central and South American countries, $7. Foreign, $9 U. S. currency, or 45 shillings per year. Canada subscription price (including Canadian duty), $7.50. Entered as second-class matter, January 20, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Cable Address MCGRAWHILL, N. Y. Member A.B.P. Member A.B.C. Number of copies printed in this issue, 13,010.

McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42d STREET, NEW YORK, N. Y.

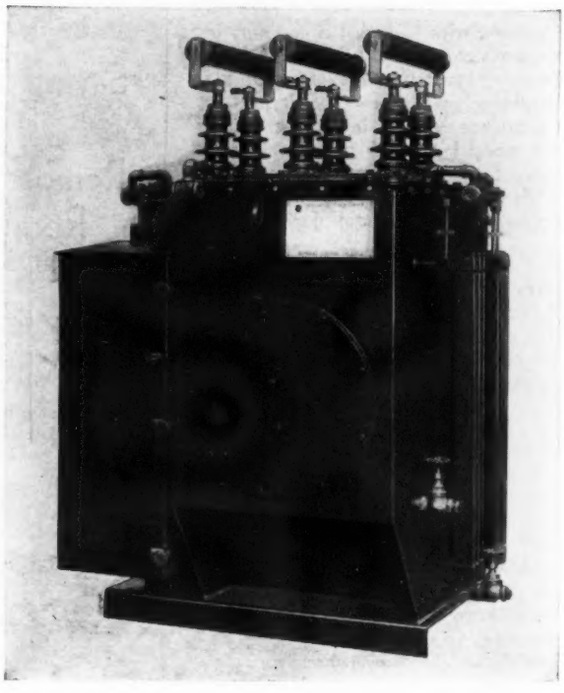
Branch Offices: 520 North Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Greenville, S. C. James H. McGraw, Chairman of the Board; Malcolm Muir, President; James H. McGraw, Jr., Vice-President and Treasurer; Mason Britton, Vice-President; Edgar Kobak, Vice-President; H. C. Parmelee, Vice-President and Editorial Director; Harold W. McGraw, Vice-President; C. H. Thompson, Secretary.

You CAN regulate your rural lines economically

THE NEW G-E STEP VOLTAGE REGULATOR offers such a simple and economical solution to the problem of voltage regulation on rural lines that it is creating widespread interest among power companies.

The G-E step voltage regulator is designed for circuits of 4800 to 13,800 volts, three-phase, 50 amperes and less. It is a self-contained, compact unit that includes a three-phase auto-transformer and a new type of load-ratio control equipment. It operates automatically throughout a voltage range of 10 per cent buck and boost, in steps of 2½ per cent.

Publication GEA-1577 describes this regulator in detail. For a copy, write the G-E office nearest you, or General Electric, Schenectady, N. Y.



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GENERAL ELECTRIC

ELECTRICAL WORLD

Established 1883. McGraw-Hill Publishing Company, Inc.

for the Week Ending

April 8, 1933

Commodity and Cost Declines No Basis for Arbitrary Cuts in Tennessee

REPLYING to the resolution of the Tennessee Senate and House of Representatives asking the Railroad and Public Utilities Commission to show cause within ten days as to why utility rates in that state had not been reduced in accordance with the price of commodities, operating expenses and general costs (ELECTRICAL WORLD, April 1, page 407) the commission has stated for one thing that rates are much lower than they were in 1913, while the cost of living is much higher.

"This commission," states the reply, "indeed no commission nor court nor legislative body, can legally order and put into effect rates which will not and cannot be made to yield, under proper management, a fair return upon the reasonable value of the property devoted by the utilities to the rendition of their service to the public" . . . "We therefore assume that it is not the desire of your honorable body, and was not the intention of your resolution, to direct the commission to order a wholesale reduction of public utility rates arbitrarily without regard to the actual operating costs of each company whose rates are to be affected, and without regard to the rate of return which such rates will produce and without according such companies the right to be heard . . ."

25 per cent cut impractical

The commission further pointed out that, in its extensive valuation proceedings, it has adhered to the elements of value set up by the U. S. Supreme Court and has omitted for rate-making purposes the value of all stocks and bonds owned. That the levels of commodity prices are not controlling factors in fair rate levels for utilities was demonstrated, because of the small use made of raw or manufactured commodities in giving service.

"A 25 per cent reduction in rates would bring about the result that many of the utilities would not have sufficient gross revenue to pay operating expenses and interest on their funded debt," concluded the commission in answering a specific legislative suggestion. "This, of course, would result in the bankruptcy of every utility company in the state . . ."

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Pennsylvania Investigators to Get Pinchot Data

Assuring the investigators of his full co-operation, Governor Pinchot has announced, after a conference with the Senate utility investigating committee and its new chief counsel, Franklin S. Edmonds, that he will give to the committee the information on which he based his charges of corruption in the Public Service Commission. "The committee arranged to request from me the information in my hands concerning alleged venality and corruption and I undertook to furnish it," the Governor said. "It was also agreed on request of the committee," he added, "that the Governor and the Attorney-General should prepare suggestions for lines of investigation which might, in their opinion, be followed with profit by the committee. The committee asked me whether *I* thought it could properly undertake the determination of rate cases as is now done by the commission. My answer was that that is what the commission is for. On the other hand, there are many questions concerning rates and the justice of rates which can be properly considered by the committee."

The committee assured the Governor it would conduct a complete, fair and impartial investigation and on this assurance the Governor agreed to sign the resolution continuing the committee and appropriating another $100,000 for expenses of the inquiry (ELECTRICAL WORLD, March 25, page 371).

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Revolutionary Steel Mill Cuts Investment 80 per Cent

Conventional methods of making steel, and old-line companies that hope to continue as they have before, may be due for a notable shake-up. Westinghouse has undertaken to supply the entire electrical equipment for the Detroit plant of the Rotary Electric Steel Company, which, among other things, will involve an investment in production equipment of but $20 per ton of completed steel, against some $100 for the output capacity of conventional plants.

The plant will use 56 motors ranging from three to 800 hp. and a 10,000-kw. furnace for the production of casting by the centrifugal process. Instead of casting an ingot in a stationary mold the molten metal is poured into a large circular mold, which is then rotated at high speed. When sufficiently cool the casting is cut into billets and rolled in the conventional manner.

It is alleged that centrifugal force acting upon the individual molecules of the steel gives the metal exceptional qualities. With drills of ordinary steel a certain machine shop was able to drive eleven holes in a given thickness of steel plate. Under otherwise identical conditions, but with drills of steel made by the centrifugal process, 41 holes could be made before the cutting edge was dulled.

The company plans to build steel plants in local areas, obtaining their raw materials nearby, and to sell their output locally. This will reduce transportation costs and add to the competitive advantage of the producer.

Plan Reorganization of Insull Units Through Eastern Holding Company

AFTER months of continuous effort partial reconstruction of the Eastern group of properties of the Insull system was announced this week in a plan presented to security holders and other creditors of the National Electric Power Company and three subsidiaries, all in bankruptcy, providing for the grouping of these units under a new company. New York Trust Company and the Chemical Bank & Trust Company, which at present hold as collateral against defaulted notes the securities of companies to be included in the new organization, have assented to the plan. The new company will be a holding company for the Michigan Electric Power Company, Penn Central Light & Power Company, Florida Power Corporation, Tidewater Power Company and Georgia Power & Light Company.

Ownership of this group of properties will be vested in 100,000 common shares, which, if the deal is consummated and all notes of the new company are paid off, will be 78 per cent owned by the receivership estate of the National Electric Power Company and 22 per cent owned by the receivership estate of the Seaboard Public Service Company. In addition to the common stock, the new company will have $4,050,000 of three-year 6 per cent gold notes, due in 1936, which will be secured by the various securities turned in by the banks and will be owned by the banks, in the proportion of $3,600,000 for New York Trust and $450,000 for Chemical Bank & Trust. The banks will thus be continuously secured until the new company has paid off its notes. The 100,000 shares will be held in a voting trust and one voting trustee will be appointed by New York Trust, one by the trustee of National Electric Power and a third by the two trustees so designated.

Would clear receiverships

In conjunction with the plan, provision is made for the wiping out of all claims between the receivership estates of four bankrupt companies in the group pertaining to the notes and securities involved in the setting up of the new company and disposition of all claims between any of the bankrupt estates and the banking institutions, as well as certain contingent claims affecting other banks. The four bankrupt estates whose claims and counter-claims will be partly settled if the plan is adopted are those of National Electric Power, National Public Service, Seaboard Public Service and Electric Management & Engineering Corporation. Referee Irwin Kurtz, to whom the plan was presented, notified all creditors of the four receivership estates that a special meeting of creditors will be held April 27 for the purpose of hearing the petitions of the trustees and for the transaction of any other business.

At the end of last week the Chase National Bank bought at auction for $4,002,540 the collateral securing a defaulted $5,485,051 note of the Seaboard Public Service Corporation held by the bank. The bank now owns all the common shares of the Virginia Public Service Company and two-thirds of the common shares of the Eastern Shore Public Service Company, together with other securities. There were no other bidders at the auction.

Middle West reorganization deferred

In Chicago District Attorney Dwight Green obtained a subpoena *duces tecum* for certain books of the National City

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Elihu Thomson, 80, Honored at M. I. T. Celebration

George B. Cortelyou, Prof. Elihu Thomson, President Karl T. Compton of M.I.T. and Gov. Ely of Massachusetts

More than 300 distinguished scientists, engineers and educators gathered at the Massachusetts Institute of Technology on March 29 in honor of the 80th birthday anniversary of Prof. Elihu Thomson, dean of living electrical inventors and versatile research pioneer. In the afternoon a conference took place, in which Dr. John C. Slater outlined the electrical theory of metallic conduction; Dr. Karl K. Darrow of the Bell Telephone Laboratories spoke on electricity released from matter, and President Karl T. Compton of M.I.T. reviewed Professor Thomson's work in electrical engineering. An exhibit of Professor Thomson's pioneer apparatus, including original pieces, attracted many visitors.

At a formal dinner in the evening President Compton announced that the executive committee of the Institute had voted to establish the Elihu Thomson professorship of electrical engineering as a tribute to the guest of honor. Congratulatory messages were received from President Roosevelt, former President Hoover, Owen D. Young and many other leaders. President Cortelyou of the Edison Electric Institute paid tribute to the guest of honor as one who is not a product of civilization, but of whom civilization is the product. H. P. Charlesworth, president A.I.E.E., emphasized the fruitfulness of Professor Thomson's career, and Vice-President Bush of M.I.T. voiced the inspiration of his educational work and interests. E. W. Rice, Jr., contributed intimate personal reminiscences of his 60 years' friendship with Dr. Thomson, and Dr. Harvey Cushing, speaking for other professions, evaluated the imponderables of his career and influence. In response Professor Thomson said that his philosophy of life has been to keep on doing those things which it has seemed most natural to do, with the invaluable aid of various associates.

Bank of New York which dealt with loans made by the bank to Insull utility companies, the affairs of which are under investigation by a special federal grand jury. Federal Judge Charles E. Woodward issued the subpoena and at the same time extended the term of the special grand jury for an additional month. Meetings of various creditors and stockholders' groups of Middle West Utilities Company have resulted in sufficient agreement that the time in which the preferred-stock holders' groups may present some plan of reorganization for the company has been extended to April 10 from April 3.

Furthr pension payments to Samuel Insull by the Commonwealth Edison Company, Peoples Gas Light & Coke Company and Public Service Company of Northern Illinois have been tied up by a suit started in the Superior Court of Cook County. The suit, filed by Attorney Sylvanus G. Lee, on behalf of James P. O'Grady, is a civil action against Samuel Insull to recover $22,000. Pending decision of the suit, the Superior Court issued attachment writs against Mr. Insull on the grounds that he is a non-resident of the state, estopping further payments to him by the companies. In the meantime it became evident that Illinois has given up hope of extraditing Mr. Insull by the departure from Athens on March 30 of Assistant State's Attorney Andrew Vlachos of Chicago.

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Boston Edison Rates and Common Dividend Cut

Directors of the Edison Eectric Illuminating Company of Boston have reduced the dividend rate on the common stock from $3 to $2.50 per share, thus establishing a 10 per cent rate on par. The stock was on a $12 basis from 1911 to 1929, when it reached $13.60, falling to $12 on August 1, 1932. Coincident with the report of the action on the dividend, President Walter C. Baylies has announced reductions in the rates for offices and stores and for power use. This reduction will save users approximately $1,000,000.

"In the past ten years," Mr. Baylies said, "the rates for residence use have been reduced five times, whereas the rates for power have remained practically unchanged, and customers using electricity for offices and stores have not benefited to the same extent as the residence customers. It is hoped that these reductions in rates will have the effect of stimulating business and aiding in economic recovery, and to accomplish this result it seemed to the management proper that the stockholders should, for the time being at least, contribute their share with the employees in making the rate reductions possible. A considerable decrease in the payroll has been accomplished by reducing the compensation of all officers and employees."

It Will Soon Be Time to Consolidate a Few Gains

Amazing progress continues in the rendering of administrative authority by Congress to the chief executive. Power to meet almost any foreseeable change in status of important affairs may soon be his. Before long a consolidation of gains should be attempted. With weak spots eliminated, efforts will be made to stimulate trade activity locally, nationally and internationally. Hazardous, indeed, if the inflationists apply their evil hand.

Hopeful little patches of blue appear in the gloom of depression skies, yet one should not make too much of them in looking for portents of a bright dawn. Energy production has narrowed the deficiency between present figures and those of a year ago to 5.3 per cent; the smallest gap, but one, in fifteen weary months. Carloadings rose 26,238 in the latest full report available; later preliminary figures indicate another rise for last week. Sustained confidence in the cure wrought for the banking situation brings currency back in encouraging volumes to the institutions from which it so precipitously fled. Security markets are definitely weak, though not panicky; trading volumes small. Commodity markets show fair strength. Coal production shows no signs of hasty recovery.

There will be a few sacrificial goats, one hears. Big business that failed to keep the faith is to provide a semblance of a Roman holiday. Bank and brokerage investigation to be continued. Other activities allied to the public interest to have their share of open censure.

On the theory that a certain number of fleas are good for a dog, merely to keep his mind off being a dog, the return of beer may be a good thing for the nation. Actually, the industry never did employ many workers. The tax returns will, it is being variously predicted, prove disappointing.

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Minnesota Law Permits Municipalities to Expand

Municipalities in Minnesota are empowered to extend electrical power and light service outside their corporate limits under a legislative act which became law April 3 upon signature of Gov. Floyd B. Olson. Passage of such an act was recommended by Governor Olson in his inaugural address last January, with the purpose, he said, "of giving farmers and others the benefit of cheaper electricity."

The law permits municipalities to extend electric service beyond their corporate limits upon a three-fourths vote of the governing body, such as a board or commission charged with operation of public utilities, and then upon submission of the proposal to the voters.

The act requires a majority vote of the voters except for villages, where a five-eighths vote is required. The municipalities may issue certificates of indebtedness to secure funds for such contemplated extensions, but the certificates must be retired out of current revenue of the municipal plant, not out of taxes.

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General Cable Closes One Plant

Simultaneous announcements of the suspension of operations at its Fort Wayne coil and magnet wire plant and of the expanding of its Chicago warehousing facilities have been made by the General Cable Corporation. These moves will concentrate production at Rome, N. Y., without limiting the speed of delivery to Middle West customers.

New York Commission Orders Utility Write-Down

Declining to sanction write-ups, from $2,275,000 to $6,500,000, disclosed by investigation on its own motion of the books of the New York State Electric & Gas Corporation, the New York Public Service Commission has ordered that company to correct its accounts and records. It has specified the journal entries to be made. New York State Gas & Electric Corporation is part of the Associated Gas & Electric Company's system.

At eight hearings, the commission reports, it developed that the $6,500,000 was to "cover a purported sale to the New York State Electric & Gas Corporation of certain parcels of land and water rights consisting of hydro-electric plants and undeveloped sites located on the Ausable, Battenkill, Wallkill and Chateaugay Rivers.

"The evidence offered with reference to the cost of the Associated system of each of the properties showed that the amounts representing the cost of the properties sold to the New York State Electric & Gas Corporation in December, 1930, were not in excess of $2,271,668, including all money expended for improvements to the properties prior to the transfer to New York State Electric & Gas Corporation and all expenses which had to do with the purchase by any of the associated companies which were shown to have been involved in any manner in any of the transfers.

"It is significant," concludes the order, "that the New York State Electric & Gas Corporation did not apply to this commission for permission to acquire these properties or to distribute the cost of the same on its corporate books, as it was required to do by the uniform system of accounts."

Coming Meetings

Northwest Electric Light & Power Association, Engineering Section, Portland, Ore. April 20-22. Berkeley Snow, 707 Spalding Building, Portland, Ore.

Missouri Association of Public Utilities—St. Louis, Mo., April 27-28. N. R. Beagle, 101 West High Street, Jefferson City, Mo.

American Institute of Electrical Engineers—District meeting, Schenectady, N. Y., May 10-12. Summer convention, Chicago, Ill., June 26-30. H. H. Henline, 33 West 39th St., New York.

Electrochemical Society—Montreal, Que., May 11-13. Colin G. Fink, Columbia University, New York.

National Fire Protection Association—Milwaukee, Wis., May 29-June 1. A. R. Small, 109 Leonard St., New York.

Edison Electric Institute—Chicago, Ill., June 5-8. B. F. Weadock, 420 Lexington Ave., New York.

Canadian Electrical Association — Lucerne-in-Quebec, June 16-17. B. C. Fairchild, Power Building, Montreal, Que.

American Society of Mechanical Engineers—Chicago, Ill., June 26-30. C. W. Rice, 29 West 39th St., New York.

American Society for Testing Materials—Chicago, Ill., June 26-30. C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Engineers' Day. Century of Progress Exposition — Chicago, Ill., June 28. G. E. Pfisterer, 308 W. Washington St., Chicago.

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Federal Power Commission Wins New River Decision

Federal Judge Luther B. Way, after nearly a year's deliberation during which arguments were twice heard, has issued his decision in the important New River case of the Appalachian Electric Power Company and Federal Power Commission (February 4, page 148). Judge Way upheld the commission and its authority to impose regulations upon Appalachian Electric Power in connection with the proposed plant. He agreed that the company should secure a major part license and sustained the contention of the commission in the interpretation of the federal water-power act giving it jurisdiction over non-navigable streams where a proposed power plant would ultimately affect the flow of water in a navigable stream.

Thus, with the sustaining of the constitutionality of Section 23 of the water-power act, is lifted a cloud which has overhung the Federal Power Commission for eight of the thirteen years of its existence. That the case will be carried to a higher court would appear likely.

Jubilant over their victory, representatives of the power commission have been outspoken in their acceptance of the importance of the decision. "A major victory in the public interest," said Chairman George Otis Smith.

Oswald Ryan, counsel of the commission, stated:

"This decision should give great encouragement to President Roosevelt's program for federal regulation of the electric power. It definitely establishes the constitutional power of Congress to deal adequately with the subject. Had the decision been against the government the President's program might have been seriously impeded."

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Louisville Rate Cut Urged in Engineers' Report

Charges of improper accounting practices by the Louisville Gas & Electric Company, excessive write-ups of capital accounts and failure to keep accurate costs and income records have resulted from the investigation of the rate situation in Louisville (ELECTRICAL WORLD, January 7, page 3). A reduction of $1,150,000 annually in the rate for electricity and an increase of $400,000 annually in the gas rate are recommended by city-appointed engineers and would mean an approximate reduction of 25 per cent in the average gas and electric bill. The J. G. Wray & Company recommendations are similar to those made by the Mayor in his suggested rates last summer.

It is proposed that two years be allowed, during which the new rates would apply, to give time for further study of the local electric and gas problems before renewing the rate schedules. Among the investigations the report urges the city to make are: A complete and detailed inventory of all property; a thorough analysis of construction costs, costs to Byllesby company of furnishing services to Louisville under engineering and management contract; a detailed analysis of general administration costs, including proper allowances for Byllesby engineering and management fees, to determine the proper apportionment of such costs and fees to operating expenses and to fix capital accounts; a detailed study of maintenance charges and of depreciation; tax accruals for various kinds of taxes included in the operating expenses and the amounts actually paid for taxes.

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Georgia Rate Cut Effects $300,000 Annual Saving

Following a series of hearings conducted in Atlanta, Augusta, Columbus, Macon and Savannah, Ga. (ELECTRICAL WORLD, December 17, page 807, and December 3, page 740), the Georgia Public Service Commission has issued an order, effective April 1, eliminating the $1 service charge to customers and establishing new rates that will effect a total annual saving of $300,000 to the Georgia Power Company's residential, rural and industrial patrons. The commission also ordered the line rental charge assessed against some rural customers of the company and suggested a downward revision of the demand charge made against large commercial consumers of power.

The new residential power rates set up by the commission are as follows: For the first 5 kw.-hr. or less per month, $1.11; for the next 25 kw.-hr. per month, $0.0666 per kilowatt-hour; for the next 25 kw.-hr. per month, $0.05 per kilowatt-hour; for the next 145 kw.-hr. per month, $0.0333 per kilowatt-hour, and for all over 200 kw.-hr. per month, $0.0222 per kilowatt-hour.

A revised schedule for commercial customers will be ready within 30 days.

It has been announced by Preston S. Arkwright, president of Georgia Power, that the changes ordered by the commission will not be contested by his company.

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Akron Votes Rate Cut; Agitation in Other Cities

Faced with recall ballots on six of its seven members, City Council of Akron rushed through an arbitrary electric light rate ordinance last week, slashing 38 per cent from the existing schedule. The measure was put through by unanimous vote as emergency legislation. The Councilmen, who have fought minority efforts to set a scale under the concessions made by the Ohio Edison Company since last December 20 (ELECTRICAL WORLD, March 4, page 280), stampeded under pressure of the recall threats and introduced a schedule which calls for $1.10 a month saving to the average consumer of current. The ordinance, providing for a three-year period, sets up rates providing 3½ cents a kilowatt-hour for the first 50, 3 cents for the next 60, 2 cents for all in excess of 100. The present sliding scale calls for 6½ cents the first 10 kw.-hr. to 2½ for users of more than 100.

Meanwhile, in Youngstown, Councilman J. G. Geltch was applauding the work of the Akron Council. "I think," he said, "it's a good idea to ask for a big reduction, as Akron did, because the company will then be willing to give some reduction if possible to avoid a court fight. If Akron gets a reduction I think we'll get the same thing here." Mr. Geltch emphasized, however, that Akron's position is totally different from Youngstown's. The Council at Youngstown is awaiting the Ohio Edison Company's reply to its request for commercial and residential electric rate reductions. In Defiance Mayor Hay has asked the City Council to open negotiations for lower rates with the Toledo Edison Company (ELECTRICAL WORLD, March 25, page 376). The Council informed him that its recent order to the Toledo company to remove its electricity distribution system after its contract expires late in 1933 (ELECTRICAL WORLD, January 21, page 86)

was made a part of a determined effort to erect a municipal light plant and not as negotiable material for a lower rate.

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Lexington Water Power Again Faces Receivership

Following dismissal of an earlier application for the appointment of a receiver for the Lexington Water Power Company (ELECTRICAL WORLD, February 11, page 177) a second complaint has been filed. The first petition, filed in United States Court, was dismissed because of alleged lack of jurisdiction. The second, filed in State Court, Columbia, S. C. has resulted in the issuance of a rule by Circuit Court Judge W. H. Townsend, giving the company until May 2 to show why a receiver should not be appointed.

The complaint alleges, among other things, that the company "has been unnecessarily extravagant and wasteful" and that the General Gas & Electric Corporation, the Associated Gas & Electric Company, W. S. Barstow Management Company and Murray & Flood, engineers, "made excessive charges for the services which they claim to have been rendered and then divided between and among themselves their excessive profits."

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New Financing at Standstill

Lack of certainty surrounding the banking situation and the low levels of business activity combined to reduce new security offerings during the month of March to practically a standstill. Utility companies, which did not enter the market in February, again in March made no public offering of either bond or stock issues.

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Montreal Utility Seeks Beauharnois Control

Quietly but persistently planning its overtures, Montreal Light, Heat & Power Consolidated is definitely working to obtain control of Canada's greatest power development, that at Beauharnois on the St. Lawrence. Various proposals have been submitted to the Canadian government by the bondholders who have taken over the Beauharnois company. The necessity of obtaining several millions of dollars to take care of future expansion of the company, as well as $16,000,000 to pay off loans made by three Canadian banks, has brought matters to a head.

The affairs of the company are stated to be in good condition. Beauharnois power is being delivered in Toronto on contract, but money is required to meet its obligations. Indications are that the only available source is the Montreal Light, Heat & Power Consolidated, which is willing to underwrite a new Beauharnois bond issue and so secure enough common stock to obtain control of the 500,000-hp. project.

It is proposed that the government approve the suggestion that Montreal Light, Heat & Power Consolidated underwrite a new issue of Beauharnois bonds to enable the company to pay off the banks and prepare for the potential development of the 2,000,000 hp. available. The original bondholders would have first opportunity of purchasing the new issue and with each bond getting so many shares of common stock. It appears, however, that the stress of economic conditions is particularly felt by the original bondholders in Beauharnois. It is almost impossible for them to buy any further. The only alternative is the Montreal Light, Heat & Power Consolidated, which would guarantee the new bonds, take them over and accordingly secure enough common stock in Beauharnois to have control.

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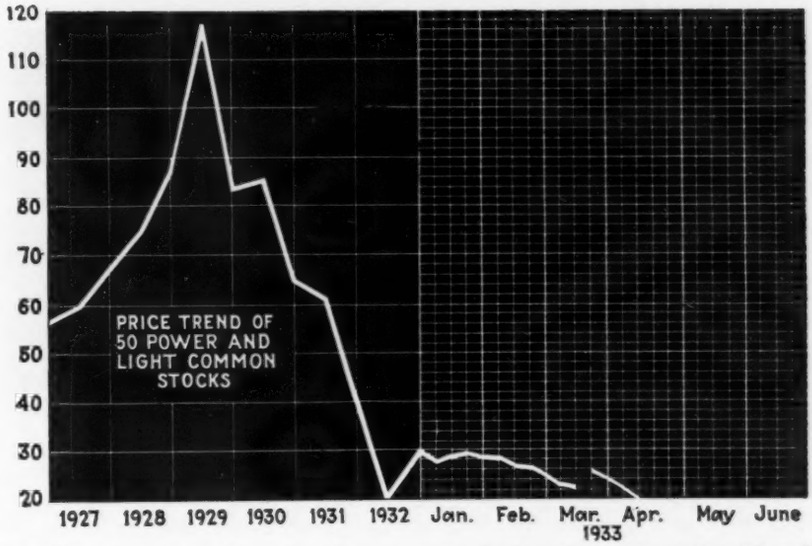
Utility Stocks Lose Ground



Security markets continued under pressure during the past week with price movements reflecting a lack of steadiness. Losses were general throughout the lists and utility stock changes were sufficient to carry the "Electrical World" index down to 20.3, as compared with 21.7 last week.

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Wisconsin-Michigan Rates

Application will be made by the Wisconsin Michigan Power Company to Wisconsin Public Service Commission for permission to make a voluntary reduction in rates for residential electric service. The schedule proposed is 8½ cents per kilowatt-hour for the first step, instead of 10 cents.

Vice-president Moody states that present earning levels do not justify a rate reduction, but that the company desires to stimulate purchasing power.

American Light & Traction Revenue Declines

(Year Ended December 31)
(Consolidated Statement)

Earnings	
Total revenue from subsidiaries	$6,067,483 2.6% below 1931
Holding company income	$1,333,650 1.2% below 1931
Gross consolidated revenues	$7,401,133 22.7% below 1931
Balance available for common dividends	$5,421,877 32.3% below 1931
Charge against surplus to pay common dividends	$1,150,597 Earned $2.89 in 1931

Balance Sheet		Compared with 1931, per Cent
Plant and property (book value)	$172,086,934	+ 0.4
Investments (at cost)	57,233,585	— 6.6
Current assets	16,724,573	+32.4
Current liabilities	12,279,803	+68.1
Funded debt	65,073,000	+ 2.4

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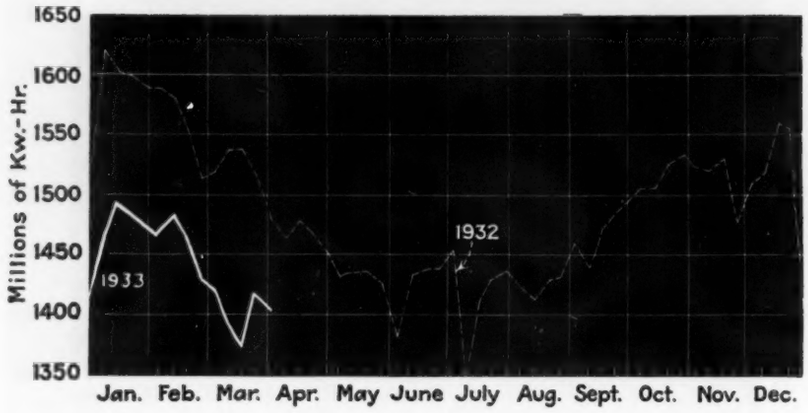
U. G. I. Earns $1.36 on Common in 1932

Year Ended December 31 (Consolidated Statement)

Earnings	
Gross operating revenues	$100,351,962 5.4% below 1931
Net operating revenue	$44,641,821 2.6% below 1931
Combined net income	$35,384,301 6.2% below 1931
Balance available for common stock dividends	$31,558,236 7.1% below 1931
Earnings per share	$1.36 in 1931, $1.46
Surplus (Dec. 31, 1931)	$96,119,247
Surplus (Dec. 31, 1932)	$80,418,194

Balance Sheet		Compared with 1931, per Cent
Property and plant	$633,680,238	+ 0.5
Investments	137,136,696	— 0.5
Current assets	45,009,525	—13.6
Current liabilities	8,495,681	—26.1
Funded debt	251,682,200	+ 1.7

Gradually Closing the Gap



Approaching closer to the corresponding output in the preceding year than at any time in fifteen months, with a single exception, electrical energy generated last week amounted to 1,402,142,000 kw.-hr., according to the Edison Electric Institute. This cuts the disparity to 5.3 per cent, against 10.6 per cent in the week of March 18, affected by the "bank holiday."

Aside from the latter the downward trend this spring seems to be more gradual than in 1932. The net change since the first week in March was a decrease of 20,700,000 kw.-hr., against 39,500,000 kw.-hr. last year.

The table of regional percentages shows further progress in the Central industrial area, moderate recession on the Coast, minor changes in the East.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1933	1932	1931	1930
April 1	1,402	1,480	1,680	1,708
March 25	1,410	1,515	1,689	1,723
March 18	1,375	1,538	1,682	1,722
March 11	1,391	1,538	1,676	1,736
March 4	1,423	1,520	1,664	1,750

Per Cent Change from Previous Year

Region	Week Ended Apr. 1	Mar. 25	Mar. 18
Atlantic Seaboard	—4.6	— 4.3	— 8.2
New England alone	—7.2	— 7.6	— 9.5
Central industrial	—8.1	—10.9	—14.8
Pacific Coast	—5.7	— 4.1	— 6.9
United States	—5.3	— 6.9	—10.6

▼

Court Upholds Commission on Potomac Submetering

In two opinions issued last week the District Court of Appeals first affirmed and then reaffirmed a decision of the District Supreme Court holding that the Potomac Electric Power Company was within its rights when it attempted to regulate the resale of electric current through submetering. The first opinion declared that the Potomac company had the right to make all reasonable rules and regulations in the proper conduct of its business. One of the company's rules provided for a ban on submetering, so that there would be uniform rates to all retail users of power.

The Public Utilities Commission of the District had approved a rule issued by the utility under which customers were required to sign a contract that electric power received by such customers would not be submetered. Upon the refusal of the company to furnish power to Myron P. Lewis and other owners of large buildings in Washington, except under the provisions of this rule, suit was brought to compel the utility to provide service without requiring such a contract. The Court of Appeals held that the commission acted within its power in approving the rule. The second case, affirming the decision, was brought by Joseph J. Moebs.

In a memorandum laid before members of the Public Utilities Commission following this decision the question was raised by Corporation Counsel W. W. Bride as to whether or not other submetering practices might come within the meaning of the decision.

▼

Electrified Railways Total 24,598 Track-Miles

According to figures compiled by the Railway Electrification Committee and published by the liquidating committee of the National Electric Light Association 31 countries have instituted electrical operation of certain sections of steam railroad lines. The figures are offered as including the year 1931.

The United States leads in both route mileage and track mileage under electrical operation, 2,066 and 4,916, respectively. Next comes Switzerland with 1,528 route-miles and 2,995 track-miles. Other leaders are: France, 1,147 and 2,483; Germany, 991 and 2,445; Italy, 1,217 and 2.444; Sweden, 725 and 1,039. World totals are 11,692 for route mileage and 24,598 for track mileage.

▼

February Energy Output 8 per Cent Under 1932

Public utility plants in the United States generated 6,223,000,000 kw.-hr. during the month of February, making the average daily production 8 per cent less than in 1932, the U. S. Geological Survey reports. The rate of decrease is the same as that for January, but materially smaller than that of several months last summer. The comparison with February of last year takes into account the extra day in leap-year.

The output reported by the Survey comprises not only that of plants for electric light and power, but of those for electric traction and others producing electricity for public use. Water power contributed 2,587,000,000 kw.-hr., or 42 per cent of the total. Coal consumption was 2,294,000 tons, of which 2,183,000 tons was bituminous and 111,000 tons anthracite.

Regional improvements are shown in the average daily output in the North Central area, now 9 per cent down from 1932, against 13 per cent in January; in the Mountain States, 11 against 16 per cent; in the Central Southwest, 7 against 9 per cent. The symptoms of recovery thus appear in regions prominent, respectively, in automobile and general machinery manufacture, in oil production and in metal mining. Other sections either maintained their January position or receded moderately.

▼

Line Regulation Costs Cut by New Type Equipment

Installation of a new type of regulator by the Appalachian Electric Power Company on its 20-mile Roanoke-Fincastle rural line has made possible the maintenance of good voltage regulation at a cost low enough to be justified by the revenue involved, according to reports. The installation was made at a cost of nearly $3,250, compared with $6,000 for induction regulators, the cheapest of other plans considered. The voltage regulation at the end of the line was brought down from its original value of 14 per cent to a figure below 5 per cent. Besides, the voltage level was greatly improved, which means that an increase in revenue will result from the improved service to customers.

The Roanoke installation is a 50-amp., 6,900/12,000-Y-volt, three-phase "step" regulator with four 2½ per cent voltage tap positions above and below nominal. It utilizes the principle of the auto-

transformer tap-changing device employed on large power transformers, automatically regulating the voltage on the load side of the equipment and holding the voltage variation within reasonable limits.

Its development by the General Electric Company, working closely with engineers of the American Gas & Electric Company, was instigated by the latter because they had encountered many cases of undesirable voltage variations on rural lines which could not be corrected by standard induction regulators or synchronous condensers without an expense unjustified by the comparatively low revenue derived from such lines.

Although this is the first installation of the new type regulator, A.G.&E. engineers believe that the comparative low cost will permit it to be used on rural or semi-rural lines where previous remedial measures were unjustified economically.

▼

Street Lighting Costs in Chicago Cut

By a change in the design of street lamps in residential districts Chicago will save $150,000 a year in maintenance and repair charges, according to William A. Jackson, commissioner of gas and electricity. For residential districts the city has been using frosted, rippled glass globes, about 35,000 out of 95,000 units, and they had to be washed at intervals. These globes have been replaced by harp-shaped standards, in which are suspended an aluminum reflector and a frosted bulb. The change will increase illumination from the lamps 30 per cent. About 20,000 of the old globes will be replaced by the new standards this year, and the new lights will be installed throughout the city by the end of 1934.

▼

Missouri Commissioner Holds Utility Rates Exceptions

Far from agreeing with those who contend that as other prices and costs have fallen to unheard of low levels in the depression utility rates should decline precipitously too, Commissioner George H. English of the Missouri Public Service Commission told an audience at the University of Missouri recently that such an expectation is "not sound."

"During these periods of depressions," said Commissioner English, "not a day passes in which some earnest and intelligent citizen does not voice to the commission the sentiment that since all other prices have come down, in his opinion utility rates should also be lowered.

"That opinion is justified only to the extent that lowered costs of labor and materials reduce expenses of operation, and affect the rate base . . . but to measure utility rates by the general rise and fall of other commodities and services under the sway of free competition is not sound.

"At a time when the merchant could, because of high demand and general prosperity, charge what he pleased and make extraordinary profits, the utility, if properly regulated, was held to a fixed and relatively low return. Now, in the stagnation of commerce the merchant is prevented from making a profit by the state of business. But he can theoretically fill out the present valley with the peak of his former gains. Not so with the utility, which had no former peak. It should not now be expected to descend so far into the valley as other businesses."

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Milwaukee Would Offset Rate Cut by Fare Rise

Increased street car fares in the Milwaukee metropolitan area have been asked by the Milwaukee Electric Railway & Light Company in a petition filed with the state Public Service Commission by G. W. Van Derzee, vice-president and assistant general manager, conditional upon any reduction ordered by the state in response to the city's plea for lower electric rates. The petition asks: "That the rates of fare be increased by the suspension of the $1 weekly pass, the withdrawal of all ticket rates in the metropolitan area and the establishment of rates sufficient to provide the company with revenues adequate to maintain its credit and continue its public services." Hearings on the demands were asked, however, only in the event that City Attorney Max Raskin is granted hearings on his plea for lowering of electric service charges.

President Way protests

Maintaining that if energy charges are lowered a rise in street car fares will be essential to preserve solvency of the company, S. B. Way, president, has said in part: "Attorney Raskin's motion before the Public Service Commission for a definite date of hearing on his petition for reduced electric service rates is the sole reason for our petition to the commission. We have sought to avoid any increase in street car fares even though the Wisconsin Supreme Court over a year ago condemned our present rates as unremunerative. . . . But we cannot continue present fares and remain solvent under current conditions if unwarranted electric service rate reductions are in any manner forced upon us and we are to be politically harassed by both reductions in rates and increases in taxes. Our residence electric service rates are now among the lowest of the large cities in the United States having comparable coal costs, even though the electric utility in the past has helped support the railway service. . . .A reduction in residence electric service rates so small as to be of little consequence in the average family budget could throw the company into bankruptcy. If we gave away residence electric service it would not relieve the present depression in any noticeable degree. For the twelve months ended February 28, 1933, the company has failed by $194,012 to earn full dividends on preferred stock held by over 16,000 stockholders and has earned no return whatever on $21,000,000 invested in its common stock. For the same period the company's return on its property investment devoted to the public service business was only 4.33 per cent. . . . From the standpoint of both the return on its investment and the failure to earn dividends, the company is at a critical point in its history. It cannot be subjected to a rate reduction on top of the drastic effects of the depression, and continue to give good service. . . ."

Major New Construction This Week

General electrical equipment, cooling machinery and transformers will be purchased for new unit of Don Carlos Brewing Company, Los Angeles, Calif. A $500,000 project.

Plainview, Tex., has called special election to approve fund of $450,000 for city-owned electric light and power plant.

Heavy-duty motors, controls, pumps, transformers, compressors, etc., will be installed in addition to Toledo, Ohio, refinery of Pure Oil Company. Cost about $250,000.

General electrical equipment to be purchased by Falstaff Brewing Corporation, St. Louis, Mo. Cost over $300,000.

Until April 26, Seattle, Wash., asks bids for construction at Diablo power plant, Skagit River, including steel tower transmission line, etc. Fund of $1,620,000 authorized.

Machine drives, motors, transformers, conveyors, etc., needed for new lead refinery near Salt Lake City, Utah, of United States Smelting, Refining & Mining Company. Cost over $350,000.

General electrical equipment will be purchased by Consumers Brewing Company, Providence, R. I., for brewing plant at Hillsgrove. Cost about $175,000.

General electrical equipment. New brewery of Zanesville (Ohio) Brewing Company. Cost about $200,000.

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New York Metal Prices

	March 28, 1933 Cents per Pound	April 4, 1933 Cents per Pound
Copper, electrolytic	5.00	5.00
Lead, Am. S. & R. price	3.00	3.00
Antimony	5.95	5.85
Nickel ingot	35.00	35.00
Zinc, spot	3.40	3.35
Tin, Straits	24.375	24.70
Aluminum, 99 per cent.	23.30	23.30

Government Sues Over Tax Refunds

Seeking to recover $492,402 alleged to have been refunded in error to three subsidiaries of the Philadelphia Company, the United States government has brought suit supplementary to that pending against the Philadelphia Company for $3,283,384. Companies involved are Duquesne Light, Philadelphia Oil, and Equitable Gas. Refunds made in 1930 on 1917 and 1918 income taxes are at issue.

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Would Leave Energy Tax to States

"Since the states were the first to utilize a tax on electrical energy, and since the conditions of the manufacture and distribution of electricity vary so widely from state to state, this commission recommends that Congress should leave this source of revenue for the exclusive use of the states." So reads the report of the Interstate Commission on Conflicting Taxation, just issued. State Senator Seabury C. Mastick of New York is chairman.

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Hydro Buys Abitibi Project

Tangled affairs of the Ontario Power Service Corporation, owner of the Abitibi canyon project, improved last week when the offer of the Hydro-Electric Power Commission of Ontario of $14,000,000 for the assets of the corporation was accepted. This bid by the commission was the only one tendered. The property was placed on sale by the Montreal Trust Company, trustee for the holders of $20,000,000 of bonds of the corporation.

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Indiana Body Accepts Rate Cut

As the first step in carrying out its announced policy of obtaining lower service charges for Indiana patrons (ELECTRICAL WORLD, April 1, page 407), the new Public Service Commission of that state has approved electric rate reductions for 26 Indiana towns served by the Northern Indiana Power Company. Cuts range from 7 to 38 per cent.

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Jacksonville Gets Tax Stay

An injunction to restrain Sheriff Rex Sweat from levying on the municipal light plant at Jacksonville, Fla., to enforce collection of the state utilities tax was granted in Circuit Court last week by Judge George C. Gibbs on petition of the city. The state claims the city owes $18,000 in payment of the gross receipts tax on public utilities, assessed by act of the 1931 Florida Legislature, and in addition a penalty of 10 per cent, alleging that the tax has been due since last spring. Jacksonville, with other cities having municipally owned utilities, attacked the constitutionality of the act, but the Florida Supreme Court recently ruled that the statute was constitutional. Efforts will be made to repeal the law at the session of the Florida Legislature, now meeting.

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9,000-Kw. Steam Boiler for Maine

Substituting a 9,000-kw. electric steam generator for the oil-fired water tube boilers previously used by it, the Keyes Fiber Company of Waterville, Me., will utilize a dump power energy rate for the service rendered by the Central Maine Power Company. Steam will be delivered for process work at 120 lb. pressure. Electrodes will operate at 4,000 volts.

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The matter of capitalization and corporate structure of holding companies might conceivably be regulated by some such federal body as the Interstate Commerce Commission or the Federal Power Commission. While I should offer no objection to truly constructive regulation of security issues by holding companies, I feel that the most effective control in these matters would be the requirement of full and frequent publicity.

C. W. KELLOGG,
President
Engineers Public Service Company.

[Mr. Kellogg urged the regulation of public utility holding companies rather than their abolition in addressing the Philadelphia Association of Security Salesmen in that city last week.]

▼

Staten Island Issue Refused

Obdurate in its refusal to approve the issuance of $5,761,000 principal amount of refunding and improvement 30-year mortgage bonds of the Staten Island Edison Corporation, the New York Public Service Commission has rejected an amended petition of the company. The original request, for an $8,500,000 issue, was rejected last June. The amended request has been the subject of several rehearings. No opinion accompanied the commission's order. The company sought to apply the proceeds from the contemplated issue to refunding purposes. Staten Island Edison is a part of the Associated Gas & Electric system.

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No Municipal Plant for Quebec

Declining to municipalize the electric services of the city of Quebec, the provincial Legislative Assembly has voted such a proposal down, 44 to 10. This action followed the appearance of Premier Taschereau before a committee of the assembly, during which he pointed out that it was the government policy, and in the interest of the province as a whole, not to imperil the credit or development of private enterprise.

Glasgow Subway Electrification

Operated since its inception in 1897 by means of cables, the Glasgow (Scotland) Subway Railway has been partially electrified. Should tests on the trial section prove that the higher operating speeds will increase the use of the system sufficiently to turn the long-continued losses to profits the Corporation of Glasgow will probably expend $500,000 to complete the electrification.

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Washer Sales Up 24 per Cent

Household washing machine factory sales in February were the best in five months and were ahead of every month in 1932 with the exception of September, according to J. R. Bohnen, secretary of the American Washing Machine Manufacturers' Association. February showed 24 per cent increase over January, which was 82 per cent ahead of December. Shipments totaled 50,518, 40,644 and 22,272 units, respectively, by manufacturers representing 90 per cent of production.

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British Columbia Leads

Domestic use of electrical energy is more extensive in British Columbia than in any other province in Canada, according to the Dominion Bureau of Statistics. In 1931 that province had the greatest density of domestic service customers with 18.09 per 100 of population. Ontario was second on the list with a density of 16.89 per 100 and Quebec third with an average of 13.07. During the ten years from 1921 to 1931 the average density for Canada increased from 9.44 to 12.89 per 100 of population

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Frigidaire Recalls 500 Workers

Recalling 500 workers to constitute a partial third eight-hour shift, the Frigidaire Corporation has brought the total of its active Dayton employees to approximately 6,500. The additional workers will be employed in the household refrigeration division.

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Florida Utility Wins Injunction

Having protested the ruling of the Miami City Commission for a reduction of approximately 29 per cent in electric light rates (ELECTRICAL WORLD, February 25, page 249), the Florida Power & Light Company was granted an injunction recently by Federal Judge H. L. Ritter in United States court, restraining the city from enforcing the order. The company was required to post $100,000 bond and an additional bond of $50,000 monthly while the case is pending. City commissioners are now considering the possibilities of a municipal plant.

Explosion Type Boilers Reach Commercial Status

No less than seven developments of the sensational Velox explosion type boiler, five of them commercial, have been made by Brown, Boveri & Company, Ltd., according to recent reports. This radical departure in steam plant equipment has been undergoing experiments for some time (ELECTRICAL WORLD, February 11, page 185). Up to the present it has been confined to the use of gas or liquid fuels, but tests to determine the applicability of pulverized coal fuel are being carried out. The capacity of the seven boilers so far developed ranges from 22,050 to approximately 60,000 lb. of steam per hour. Applications include iron works, chemical plant, electric power station, sugar mill and tramp steamer.

Velox boilers have a notable operating advantage in that they may be started up with extreme rapidity from the equivalent of a banked condition. Full load can be assumed in about seven minutes. Assuming boilers operating under pressures of 425 to 570 lb. per square inch, the approximate ratios between ordinary boilers and those of the Velox type will be: Heat capacity, 1 to 10; quantity of steam generated referred to operating surface, 1 to 10; quantity of steam generated referred to all heating surfaces with superheater and feedwater preheating, 1 to 10; quantity of heat generated per cubic unit of combustion capacity, 1 to 10; speed of gases between the water pipes and respectively in the fire tubes, 1 to 10; weight of complete boiler per pound of steam generated, including auxiliaries, 4 to 1.

Interesting among advantages are the reduced space requirements. In substituting Velox boilers for Diesel units in a power plant it was found that the latter required only about 25 per cent of the space the former occupied. As the weight was considerably reduced, lighter foundations and cranes would have served. In a steamer installation, where the substitution of Velox for Diesel was made, the output was increased from 6,200 to 7,800 hp., with a reduction in the weight of boiler plant from 400 to 80 tons.

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Soviets Find Lost Turbine

Back in 1916 the Imperial Russian Government ordered a 360-kw. turbo-generator set. The World War went on. The Little Father of all the Russias fell before the bullets of revolutionists. The electrical art progressed. The turbine, in its original packing case and still slushed with grease, came upon strange adventures. It has been found 50 miles from the nearest railway somewhere beyond Moscow. Soviet officials seek to put it to work and have ordered parts from the General Electric Company to replace those in a missing crate.

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Excavation for Hoover Dam Base Starts

Wide World

Preliminaries over, the actual construction work for Hoover Dam is now under way. As shown in this downstream view the excavations for the site of the huge dam are in the immediate foreground. Beyond are the openings from various discharge tunnels and at the left in the extreme background the outlet from the diversion tunnel through which the waters of the Colorado River are carried around the dam site during construction.

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Gas-Filled Cable Tested; Shows Many Advantages

Development and test of a gas-filled cable which is said to overcome many of the disadvantages of the more familiar types was announced at the March meeting of the Institution of Electrical Engineers (England). C. J. Beaver of W. T. Glover & Company, Ltd., pointed to the somewhat paradoxical fact that the nearer one gets to freedom from ionization conditions in the familiar types of cable the greater is the liability to produce ionizable voids under working conditions by reason of the lack of compressibility of the dielectric. By substituting a proportion of gas for the usual materials compressibility at constant volume may be obtained.

In tests a 66-kv. section has been stressed to 140 kv. per centimeter. This cable was fabricated by winding upon a sheathed, stranded conductor insulating paper impregnated before application with a compound which remains solid at the highest temperature that the cable is likely to assume. Another sheath is applied over the paper and gas is introduced, finding accommodation in the spaces left by the convolutions of the paper wrapping.

Some advantages found

According to Mr. Beaver, this construction is entirely independent of the density of the paper or the effects of the viscosity of the impregnating compound. There is no movement of compound radially or longitudinally on heating or cooling and the gas cable is independent of the rate of heating or cooling. Heating cycles produce no alteration of the power-factor-voltage curve, which remains perfectly flat, up to the voltage value which is definitely predetermined by the conditions of the film dimensions and the pressure of the gas. Twice working voltage is well within practical range for this ionization voltage.

The gas cable is independent of gradient and can be run to any height vertically. It has greater current-carrying capacity because of its complete physical stability. Gas cable is applicable to any required voltage. It requires no external apparatus as it is simply charged to the desired pressure and sealed off. It is said to be potentially cheaper than any previously existing design.

EDITORIALS

L. W. W. MORROW
Editor

Employee pensions and the new social concept

SOME interesting facts have been developed out of a research by the Industrial Relations Counsellors, Inc., a Rockefeller interest, on the present status of pensions in industry. It finds that only 8 per cent of the 4,000,000 workers now covered by industrial pension schemes are dependably protected. Nine-tenths of the workers covered under all plans may lose their pension prospects due to lack of either legal or financial guarantees. Therefore, employee interest is small, because they have no confidence of security. Company deficits, mergers and other contingencies have not infrequently wiped out pension programs. Long service requirements too often call for 25 years' continuous employment, which becomes increasingly difficult to achieve under modern conditions. Employee contributions, while accelerating the accumulation of the fund, call for even greater confidence based on the protection of the employee who quits or is discharged. It is a subject of increasing importance to electrical men, as in all other industries, and too little thought has been given to it.

Out of this depression is slowly emerging a new concept of the social responsibilities of industry. When a corporation absorbs the lives of human beings, through continuous employment, says the new philosophy, it becomes responsible for their welfare. Just as the employer gives thought to their physical health by providing good working conditions, so should he also provide in some measure for their economic health, by assisting them to attain a degree of security for times of adversity or for old age. And management should be able to make such security worth what it costs, through a lower labor turnover and an increased efficiency.

In the Swope plan, providing for a co-operative administration of unemployment insurance, with a cumulative pension equity, that follows the worker from job to job, the electrical industry has already given evidence of a quickening conscience in this matter. With the first relief that comes with better business steps should be taken to establish some effective plan, both in the name of social justice and for the economic advantages that will come out of it.

Unaccounted-for losses are tomorrow's dividend reservoirs

IN THE effort to escape the shock of the collision when lowered rates meet rising taxes on the single track of utility economics, more and more attention is and should be given to the unaccounted-for energy. Peculiarities of individual systems partly explain a spread of from 10 to 25 per cent of the energy pumped into distribution systems which does not appear in revenue-producing kilowatt-hours. Highly scientific operating technique of the power system manipulates individual generation efficiencies and system links so that losses from scheduling units are kept to fractions of a per cent. But sometimes these economies are then squandered in the far-flung distribution system. Some of this system loss will of course remain unavoidable, at least until zero resistance conductors and zero-loss iron become commercial realities, but those are just dreams.

What to do about it? There are many answers, but the first to apply is—locate all the components of loss and focus on the big ones first. Primary copper loss may take from 30 to 40 per cent. The secondary usually accounts for 5 per cent or less. The transformers often represent 15 to 25 per cent of the total. Regulators, meter losses.

meter errors, unauthorized diversion, necessarily unmetered company use and other similar items account for the rest of the loss. In a well-managed property these factors all receive attention when the system is extended or intensively revamped. It is the *status quo* part of the system that is neglected.

This present mark-time period is supremely adapted to a searching study of this source of revenue. It holds the marginal dividends of the future. Scrapping high-loss facilities and investment in a more efficient set-up are by no means the only moves involved. Distribution technique and philosophy themselves are due for a jolt that will jog lagging staffs out of their lethargy. Loads of the future are destined to be greater in the very areas where the losses primarily arise. Planning for loss reduction means planning for the loads ahead as well as for the hesitant loads of the present. The industry should never feel satisfied with distribution losses until the technique in that field commands the same respect as now accorded to joint handling of water and steam and of generating units of varying sizes and efficiencies.

The verdict on street lighting

DURING recent months street lighting has been "on trial." As a means of reducing expenditures, practically every municipality has considered street-lighting reductions—or so it would seem, judging from the frequent newspaper accounts. And many of these contemplated reductions have actually been put into effect, there can be no question.

Yet the recently compiled N.E.L.A. figures for 1932 show that, taking the country as a whole, street lighting was not reduced far below the 1931 levels, as might have been supposed. Surprisingly, it was not reduced at all; it increased!

True, the increase in street lighting was not large—of the order of 1½ per cent. But, in view of the terrific pressure upon it, the fact that it even held its own is of the utmost significance. This means that the public regards street lighting as one of the essential municipal services and one whose value exceeds its cost. The court of public opinion has rendered its verdict, in no uncertain terms. This verdict, together with the accumulated evidence on the economic worth of adequate street lighting, should be made known wherever reductions are contemplated.

Stroboscope becomes a new aid to mechanical design

UNTIL recently the stroboscope has remained a useful adjunct of the laboratory in studying departures from synchronous speed of synchronous and non-synchronous apparatus. Its field of usefulness in non-electrical fields is now being extended just as the electrical means of measurement are being extended to embrace all sorts of non-electrical quantities. By this perfection of the stroboscope one can envision a great improvement in the technique of mechanical design as applied to fast-moving apparatus whose parts are subjected to rapid impulse forces. Future design of such mechanisms will use the practicalized stroboscope to effect more economic and durable employment of materials because studies with photoelastic models will reveal where the stresses localize and how they are propagated. Maintenance engineers will also be enabled to learn how mysterious failures of automatic machinery can be averted when it ceases to produce smoothly and reliably.

Notable among the advances in this direction are the accomplishments of Edgerton at Massachusetts Institute of Technology. His stroboscope is capable of taking 4,800 pictures per second on a continuously moving film without camera shutter. The intensity of the mercury-arc light obtained by controlled discharge of some 1,000 amperes from a charged condenser gives an intensity that would demand 2,000 kilowatts of incandescent lamps to create the same actinic effect on the film.

The speed and positive regularity with which pictures can be taken open to it a field which far transcends the capacity of the conventional shutter type of stroboscope which every electrical student remembers. Electrical men scattered through industry will see a multitude of non-electrical problems whose answer can be found by taking still pictures of rapidly moving objects whose erratic behavior might otherwise remain a mystery and a waste.

Design for Progress

Fundamental developments should be made.
Use of analysis, plan, new processes and new materials advocated.
Commercial and sales aspects of equipment design.

By J. B. MacNEILL
General Manager Distribution Engineering
Westinghouse Electric & Manufacturing Company

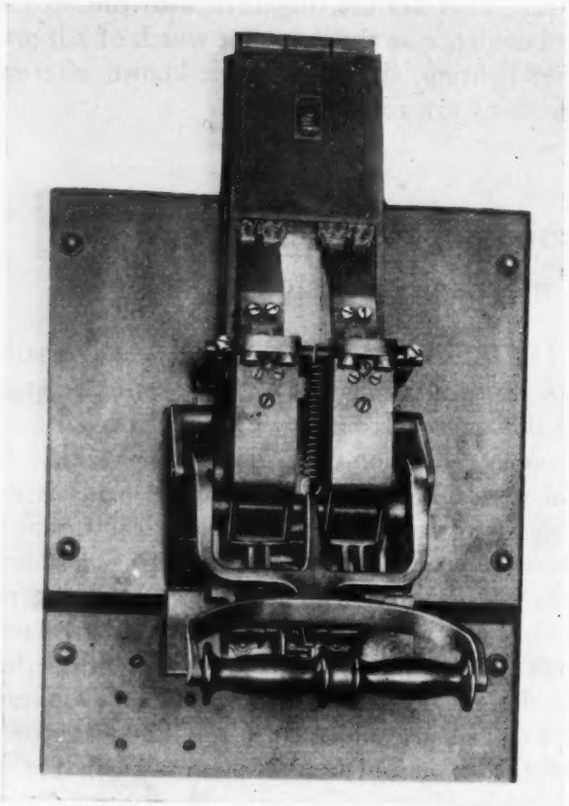


Fig. 1—Engineers found out some new fundamentals of current flow when designing these carbon breakers

WHEN we consider the large sums of money spent by the great industrials in development work to keep their lines up to date we are tremendously impressed with the responsibility of the designer. No loss, except that of human life or happiness, is more tragic than thousands of dollars thrown into inadequate designs which because of defects are limited in life and sales prospects. Such a loss is of the same nature as a disastrous fire or flood, which represents pure waste of money and effort. If a man builds a poor house it can still be lived in; that has been proved too often to be disputable. If a woman burns a pan of biscuits the outcome is not altogether unfortunate, because the charcoal is good for you anyway. But when an organization sinks thousands of dollars into a line of equipment, shops, tools, stocks and advertising, and then finds it will not sell, we have a tragedy of the first order. I heard an executive say some time ago of an eminent engineer: "He ought to be good, we wasted $40,000 on his first job getting him educated." Poignant memories of youthful efforts demand of an older engineer that he try on all occasions to impress on the younger men the responsibility that they have, not only for their own time but also for the time and efforts of the whole organization, which he sets in motion when he brings out a new design.

Let us assume that a designer knows approximately the job set before him. He is told that a new line of induction motors is wanted, or a new means of rupturing alternating-current circuits, etc. Large companies do not spend development funds until the exact job is pretty well clarified.

A first job for the designer on being given such an assignment, possibly not the first job but at least one of the first jobs, is to carefully survey the methods being used in industry to secure similar results. In other words, he must size up competitive apparatus. A young designer may feel that analyzing a competitor's products is below his dignity, but, fortunately or not, brains are widely scattered and many people working in different parts of the country on the same problem will sometimes arrive at very similar results. Incidentally, most of these results will be better than any young designer's for the first few years, unless he is very careful.

In this connection do you accept as reasonable and adequate the limitations that are imposed in your field, either by past practice, national standardization or the standards of your own company? If you plan to use a silver contact in a control device, why should you be limited by the 30 deg. rise specification of the A.I.E.E. for copper parts, or the 20 deg. rise for laminated brushes, or the 12 deg. rise for navy use? These limitations have been imposed because copper oxidizes readily and to an increasing degree at high temperature. Silver, under ordinary conditions, does not oxidize and its use

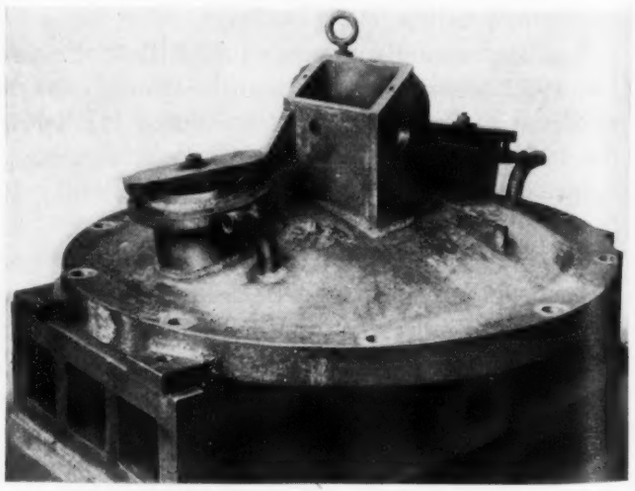


Fig. 2—Fabricated steel has replaced castings in many types of electrical apparatus

makes possible lighter parts, taking smaller space and of less cost. On the other hand, if you sense that present standards are not adequate you should not abide by them, but make your apparatus good for operating conditions as you know they exist. As an illustration, we felt as much as ten years ago that the A.I.E.E. standard of 2¼ times plus 2,000 for test voltages on switching devices was wholly inadequate for power station service. We stated the conditions to the trade and made our 15-kv. apparatus good to meet the A.I.E.E. test established for 25-kv. apparatus.

After you have got the abilities and the limitations of existing equipment clearly outlined, you should ask yourself what fundamental ideas you have that justify you spending money for a new development. You are rarely justified in bringing out a new line of apparatus just to place one more company in that field. Most lines have enough competitors already.

Since a line of apparatus should last at least five years, the designer must assume, before bringing out a new one, that there have been developments since his previous line was designed sufficient to require such new line to be radically different from the old. Research departments have been active, outside inventors continue their work, and foreign countries have problems very similar to yours which they solve with great ability, having in mind export trade and the free-for-all fight for business therein. Generally, if one looks far enough, he will find fundamental improvements in the ways of accomplishing his purpose. Cobalt steel is revolutionizing instrument design. Transformer and machine iron has much smaller losses than that of years ago. Great improvements have been made in insulation. Electronic devices are replacing mechanical devices, and are especially valuable for high-speed functions because they have no inertia of moving parts. The "Deion" principle has revolutionized air breaker design and the "Deion grid" has done the same for our oil breakers. Tungsten alloys are available with arc-resistant properties, greatly superior to copper, nickel and previously available materials. *The ambition of a designer should be that his new line will live until outstanding developments in the art make it obsolete.* It will not always be possible to get this result, because obsolesence may result from many causes and ordinary economic factors of cost and performance may force new designs. However, if the above goal is kept in sight the results obtained will be superior, and necessarily this means incorporating the most modern research and inventional developments applicable to the subject.

To this end the designer may decide that he is not satisfied with such fundamental developments as have been made and he may stimulate this activity. You will remember that Edison never felt highly of the invention of the telephone, because he said it was merely a discovery. What he meant was that true invention is the working out of methods and devices to secure desired ends. Our research departments work along these lines. They set themselves a task; for instance, a new method of opening a.c. arcs; a rectifier with a lower arc drop, etc. They then correlate the existing knowledge on the subject, analyze the factors having a bearing thereon and set to work to remove the limitations and build up those elements which may assist in a solution. The research man needs and values the stimulation of the design department, otherwise the work is frequently misdirected. At the same time, the designer, if he can visualize a desirable attainment, can ask his research people for the solution of definite problems and thus secure outstanding fundamental ideas for incorporation in his designs.

This kind of work must be done well in advance, as time is essential to proper development and co-ordination of new ideas. For illustration, we are now starting the design of a line of air circuit breaker apparatus for which fundamental disclosures were made several years ago. The design work could have been done at that

Fig. 3—For years carbon breakers were hand operated and mounted on the front of a switchboard

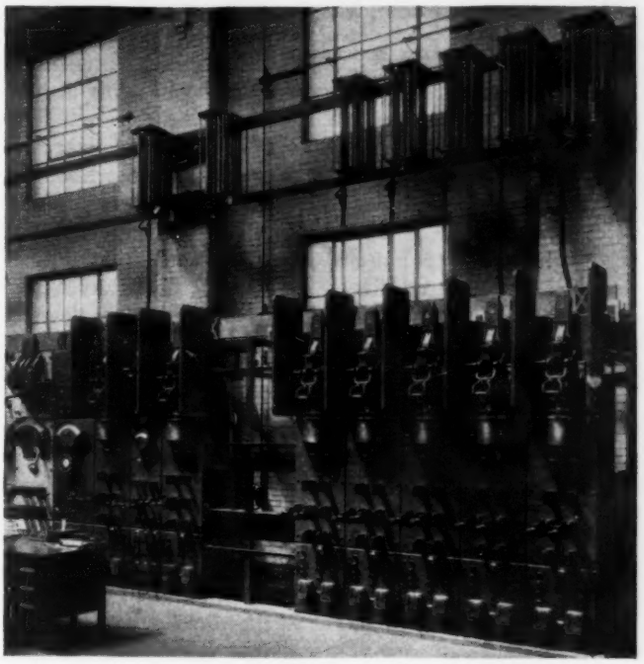
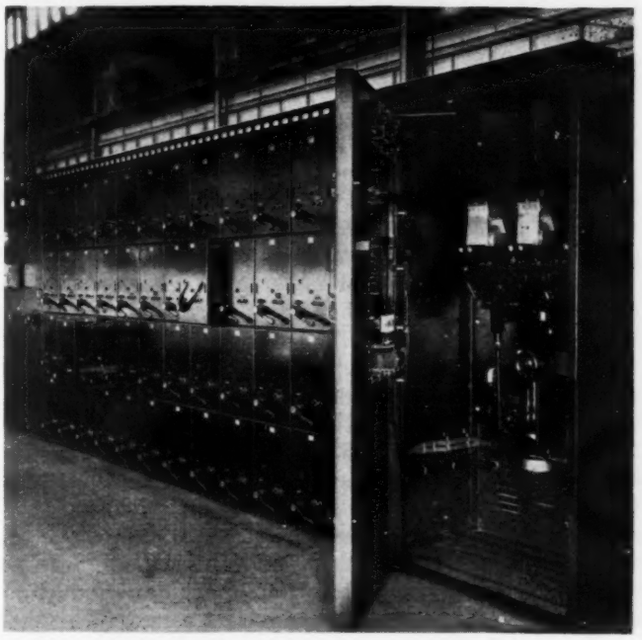


Fig. 4—Today carbon breakers are metal clad and mounted back of board for safety reasons



time, but the results are going to be better on account of the delay, because allied work on other lines has clarified and perfected our ideas.

Must represent progress

Unless your proposed line is underlaid with fundamental advances you are in a vulnerable position. Several companies have spent large sums in the last two years for new lines of fuse devices usable in panelboards, distribution, switchboards, etc. These lines are complete in every detail, very economical in space, fairly low in cost, convenient to handle, and an outsider would say that had an assured life. However, there have been fundamental improvements in circuit-rupturing devices, and it is obvious that the fuse no longer holds the position it did in the distribution of electricity. In fact, the fuse may soon be a thing of the past for most purposes. As a result the designs of these new lines of fuse devices must rapidly align themselves with the newer trends in the industry, whatever effect it may have on their investment in fuse devices. Another illustration is that of companies which recently have decided to compete in iron-clad switchgear along conventional lines. Modern improvements in circuit rupture for high power a.c. circuits make the outlook in this field entirely different from what it was a short time ago. The point is that radical improvements in the art may render obsolete almost over night expensive developments and apparatus. No manufacturer and no design of apparatus is proof against such a possibility. Each has the opportunity, however, to keep ahead of his field by constructive work.

Number of sizes to make

Having determined the fundamental principles on which your new line will be based, you will be interested in the number of sizes required to cover the field. This subject has been discussed frequently and there are many economic factors involved. However, there are two points I would like to mention:

First, in some kinds of apparatus the determination of sizes does not enter, but there is a similar problem involved. I refer to small apparatus. There is no need for two sizes of some relays, watt-hour meters, or of many standard instruments. The requirements are such that the most compact device which will fulfill the functions is adequate. However, much good can be gained by grouping small devices together and analyzing them for common parts. Thus a new line of switchboard instruments, ammeters, voltmeters, etc., has been perfected, of which many parts, as the case, terminals, etc., can be used directly for other apparatus including induction relays for overload, voltage control, reverse power, etc.

The second point in connection with sizes is that definite limitations are sometimes imposed by industry requirements and any co-ordination of sizes must be adjusted accordingly. This is frequently true of auxiliary apparatus whose size bears a definite relation to main machinery. For illustration, a 3 per cent reactance in a 300-amp. feeder out of a large generating station requires a circuit breaker having 10,000 amp. rupturing capacity for that feeder. Again, a 500-kw., three-phase transformer is the largest that certain cities will allow to be mounted in vaults under the streets. Pole-mounting apparatus has inherent limitations of size and shape.

Sometimes a size will be determined by a sharp change in the cost curve. To illustrate, a 600-amp., 60-cycle conductor can be taken through a steel wall without overheating the steel, but 800 amp. requires bronze construction. Therefore, 600 amp. is frequently an economical size for switchgear and control devices. Again, 2,000 amp., 60 cycles can be carried through one stud of moderate size, whereas 3,000 amp., 60 cycles either takes a stud of excessive size or the conductor must be split in two. Frequently, therefore, 2,000 amp., 60 cycle is a determining size because of cost. Again, selector switches may carry a load of two feeder switches with many types of bus connection, and this determines 1,200 amp. as a capacity to take care of two 600-amp. feeder switches in parallel. Sizes as determined from preferred number series must not overlook inherent limiting factors such as these if total cost is to be a minimum.

The designing engineer will have many opportunities to use his fundamental training when working with electrical apparatus. Grotesque results may be secured if the laws governing current flow, heat flow, insulation graduation, magnetic field distribution, etc., are disregarded. As a simple illustration, an air circuit breaker was originally designed with three brushes in parallel. It was found on 60-cycle test that it did not meet its current rating with the standard temperature rise. Analysis showed that the current was being practically all carried by the two outside brushes, with the middle one doing no work. The design was corrected by eliminating the middle brush, which gave a ventilation chamber through the center of the breaker and reduced the operating temperature, at the same time materially decreasing cost.

Maximum economies in production are only possible where each piece has the greatest feasible activity and is used in the largest possible number of applications. To do this there is required careful layouts of all sizes of a line, the choice of pieces best adapted for interchangeability, and then the working over of the line to incorporate them. For example, a circuit breaker mechanism can be designed so that most of its parts are used in eight or nine different breakers. The main lever is used for three voltage classes, 46 kv., 69 kv. and 92 kv., and also for various rupturing capacity classes, as the half million, million and million and a half, and accommodating all the ampere capacities required in each frame. The same holds true for the other levers, the dashpot, the fabricated lever box, bearings, etc. There is a similar interchangeability among 69, 115 and 138-kv. breakers.

It is generally possible to go further than simply interchangeability of individual parts. Interchangeability of partial assemblies is very desirable. A small oil circuit breaker was designed in 1919 and has been changed very little to the present time, but which on account of its excellent design still is entirely competitive. This was one of our early uses of pressed steel in switching equipment and at the time it was brought out was so novel that it had to be approved by the vice-president in charge of engineering and shop, because of objections from some members of the organization. Notice that this is a class of equipment which it is desirable to stock in many locations throughout the country, such as service shops, district warehouses, stocks, etc. The ability to put together various combinations easily is a great advantage in such a case. Note that the circuit breaker unit itself is detached from its operating levers, overload coils,

undervoltage device, bell alarm, signal switch, etc. It can be made switchboard mounting, panel frame mounting in the rear of the switchboard, remote control, or electrically operated without modification of the circuit breaker unit, and each auxiliary or any combination of auxiliaries can be applied without interfering with any other.

As a further illustration of interchangeability of parts and grouping of part assemblies, a line of small carbon breakers was made. The variety required in this apparatus is tremendous, including many ampere capacities of series overload coils and arrangements of pole units and auxiliaries, such as undervoltage, reverse current, shunt trip, signal switches, etc. At the time this line was designed it was figured that 92,000 combinations could be serviced with a minimum number of parts by the type of design used. Each partial assembly is completed and tested by itself to a specification which insures its proper operation when assembled in the complete breaker. That is, the undervoltage device, for illustration, is designed to deliver, say, 3 lb. pressure to a trigger, and the design of the breaker is co-ordinated so that not more than 3 lb. will ever be necessary to trip. Further, the travel of the auxiliaries is so arranged that extreme accuracy in locating it with respect to the breaker is not essential, and it will do its work with the type of assembled job that may be expected of a small switchboard builder or service shop man.

Advent of fabricated steel

Fabricated steel has largely replaced castings for many types of apparatus in recent years because of the perfection of methods for cutting, welding and forming. Sheet and bar material is more homogeneous than castings, porosity is eliminated, production can be better controlled and speeded up, there are no delays at the last minute due to opening up large blow holes when machining, the cost of tool equipment is less, and opportunitiy is given for use of interchangeable parts.

For many purposes fabricated steel will give approximately 15 per cent lower factory cost and considerable saving in tool and shop equipment. In the highly competitive markets of today such a saving may represent the total difference between profit and loss.

A new line of designs naturally presents the opportunity to meet changed trade requirements which the obsolete features of the old line made difficult. It is general experience that after a line has been on the market for some time the demands change and the manufacturer is forced to bolster up his line by adding features and auxiliaries which are encumbrances on the original design and make competition difficult. Take the case of low-voltage a.c. switching. The carbon breaker was originally a hand-operated device designed for mounting on the front of a switchboard, with plenty of headroom above it, and operated by a qualified attendant standing on a rubber mat who knew enough to stay away from the live parts. However, as time went on, the trade has added requirements. Carbon breakers now must be full-automatic so that an unauthorized person cannot hold the breaker closed against a short circuit. They are more generally required to be electrically operated from a remote control point to keep the operator out of contact. They are frequently mounted back-of-board, involving special construction for safety reasons, and more recently are built into iron-clad arrangements and sometimes equipped with small trucks for drawing them in and out of connection. The result is that conventional carbon breakers meet the new requirements only with difficulty, and the fine finishes that have been given them in the past are no longer useful when they are mounted in steel houses. The time is ripe for a new line of apparatus which shall not have large arcs drawn upon circuit rupture, shall have no exposed parts on the front of the structure, shall be full-automatic in all positions with the minimum of parts, shall not be limited by the 20 deg. rise specification of brush copper, etc.

Appearance is all important in apparatus design. There is a saying which our German friends use speaking of a design they do not like: "It is no good, it doesn't even look good." Since beauty has been a goal for man these many thousands of years, it would hardly seem necessary to emphasize the necessity of good appearance in electrical apparatus. However, not everybody is born with a sense of beauty, and where pressed for an adequate technical solution many engineers allow appearance to become secondary. Recently I saw a power transformer made by a large manufacturer equipped with a large number of ordinary household fans mounted on the radiators and covered with chicken wire. The result was something which looked like a pet squirrel shop. I have also seen recently a piping scheme on a large machine which I am sure could have been improved on by a good plumber. People like Lamme, Schmidt, Davis and Aalborg, who made our original designs, knew the value of appearance and insisted on it. It is up to the younger engineers to uphold this standard. By good appearance is not meant necessarily that a thing be pretty. In fact, attempts to artificially "doll up" a design may be disgusting to the observer. A design should, however, give the appearance of being purposeful. Each part must indicate its use and desirability. It must be in harmony with its surroundings and be business-like and wholesome-looking.

Create selling points

At the risk of being called too commercially minded for an engineer, I wish to state my belief that a designer should have uppermost in his mind the creation of selling points. There is no gain in reducing factory cost by $10 if the sales department has to increase its cost $25 in order to sell the product. Your apparatus may be inferior to none, but to get it across to the trade you must be able to select certain outstanding characteristics to focus your customer's attention on. It may have longer life, may be more convenient or economical to operate, may require less maintenance, may have desirable safety features, may be better in appearance, may be easily transferred from one location to another, may incorporate fundamental advances in the art, improved materials and improved methods. Things of this kind will help. Take a tip from the automobile people; even if it's the old bus with a different color of paint, they are sure to announce 64 new features exclusively owned and controlled by the Jinks Motor Car Company. Fundamental improvements are made in automobiles and they get talked about, but a great deal of the current attention and discussion is focused on small, inconsequential things which make good talking points.

A progressive step in design stands out in relief if previous devices are known by the trade to be inadequate. The use of wood in electrical apparatus has been general, but its lack of uniformity both mechanically and electrically make it a questionable product. When you point out how you have got away from it in a new design, even though it is still generally used by the industry, there is left in the customer's mind the feeling that perhaps there are other points in your design which are superior to competition. For some purposes porcelain is inadequate because it will not properly resist the racking strains of short-circuit stresses. When you explain the virtues of terminals made from phenolithic products you place your competitor on the defensive to explain why porcelain should have a place in his modern devices. If your competitor uses ordinary tank linings where an arc may impinge upon them, then you should reinforce yours with asbestos, and again he must explain how he expects combustible material to withstand the effects of an arc and give superior service. Here is a place the research department can help. Before you start your new design analyze the probabilities that you will have to use inherently inadequate materials and see what can be done to replace them.

Of course, your design must be fundamentally sound or talking points in themselves will be useless. Don't overlook, however, the probable reasoning of the average customer that the designer who takes care of features of this kind has probably done a first-class job on his apparatus throughout.

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Advanced Installation for Greater Economy

By A. H. KIDDER
Assistant Engineer System Planning
Philadelphia Electric Company

There are conditions under which the installation of additional facilities would permit effecting system economy. Perhaps the economy is estimated to be large enough to make the installation of such facilities appear to be an attractive business proposition. However, there is the possibility that unexpected changes in requirements may within, say, three to five years reduce or even eliminate the saving which can be credited to such new facilities. Careful planning can minimize, but not necessarily remove, this element of uncertainty. Capital expenditures for temporary construction involve high amortization costs. Therefore, an attitude of extreme caution is properly taken toward temporary installations.

In analyzing construction requirements for the natural expansion of the system, however, there will be found cases where the installation of facilities, later required by load growth, might be advanced to permit taking advantage of system economies prior to the normal installation date. Thus, system economy may, in some of these cases, considerably more than offset all of the costs incurred by the temporary use of a comparatively permanent installation under conditions where the economies possible would not justify the use of temporary construction.

An example of such an opportunity presented itself to the Philadelphia Electric Company not long ago. It became evident, after the merger of the Philadelphia and Suburban properties, that very material operating economies could be effected if the generators at Barbadoes Island station could be shut down completely during certain months when the capacity of the more economical generating stations would be adequate for the system loads. It was found, however, that a new 66/33-kv. transformer bank would be needed to supplement the two existing Barbadoes Island banks in maintaining the firm capacity needed for the supply to the local loads if the generators were to be shut down. Analysis indicated that additional transformer capacity would be required for load growth in the area within about two years if the station were not shut down. It was also found that the total construction cost involved in this and other related projects was practically independent of whether this bank were installed at Barbadoes Island or at the nearby Plymouth Meeting substation. Consideration of present and probable future operating advantages led to the selection of Plymouth Meeting substation as the location for the new 66/33-kv. transformer bank.

Comparison of Economics of Alternatives

Continuation of old station or shutting down and installing transformer bank.
Estimates, expressed in per cent of cost to install the Plymouth Meeting 66/33-kv. transformer bank

	1931	1932	1933	1934	1935	1936
1. Barbadoes Island Generators Shut Down 3/31 to 3/1/34						
(a) Annual charges on Plymouth Meeting bank to be installed 3/1/31	11.7	14.0	14.0	14.0	14.0	14.0
(b) Annual charges on installation of 33-kv. bank at Emilie by 10/1/35	0	0	0	0	1.9	7.6
(c) Operation of Barbadoes Island generators (differential system costs)	5.6	0	0	28.0	33.6	33.6
(d) Total	17.3	14.0	14.0	42.0	49.5	55.2
2. Continued Operation of Barbadoes Island Generators						
(a) Annual charges on installation of Plymouth Meeting bank by 10/1/34	0	0	0	3.5	14.0	14.0
(b) Annual charges on installation of 33-kv. Emilie bank by 10/1/33	0	0	1.9	7.6	7.6	7.6
(c) Operation of Barbadoes Island generators (differential system costs)	33.6	33.6	33.6	33.6	33.6	33.6
(d) Total	33.6	33.6	35.5	44.7	55.2	55.2
3. Net Economy in Each Year	16.3	19.6	21.5	2.7	5.7	0
4. January 1, 1931, Value of Net Economies Summarized in Item 3	1931	1932	1933	1934	1935	5-yr. total
(a) 7 per cent compound interest discount factor (by years)	0.935	0.873	0.816	0.763	0.713	....
(b) 1/1/31 value of net economies	15.2	17.1	17.5	2.1	4.0	55.9

Careful analysis of these related factors then indicated such a large margin in favor of advancing the purchase and installation of the new bank that it was placed in service and the Barbadoes Island generators were shut down in March, 1931. The analysis was based upon a two-year shut-down, after which it was estimated that additional capacity would be needed to permit continued shut-down. Subsequent recession of loads has postponed the time when such additional capacity will be required and has increased the savings which may be credited to the project. The loads encountered to date would not have permitted shut-down without the installation of the new bank.

The accompanying table summarizes an economic analysis, brought up to date to take into account actual conditions in 1931 and 1932 and estimates for the next four years. From this table it will be seen that the January 1, 1931, value of the net economy possible by advancing the installation of this large transformer bank already amounts to about 30 per cent and will in all probability amount to a five-year total, equivalent to approximately 50 per cent of all the investment associated with providing the new bank. This represents the savings, after deducting 7 per cent return on the investment, taxes, insurance, reserve for renewals and replacements, operating and maintenance charges. Furthermore, these savings are expected to accrue before the transformer assumes its normal permanent supply of capacity needed for load growth in the area.

In retrospect, it now appears that the economies might have justified even the heavy amortization charges associated with temporary construction. It is difficult to say what would have been done, but it is doubtful whether the shut-down plan would have been adopted if it had required temporary construction.

There will be an opportunity, during the next year or two, to consider whether it is then desirable to continue with the Barbadoes Island generators shut down and, if so, whether the advance installation of a second transformer bank at Plymouth Meeting will be justified.

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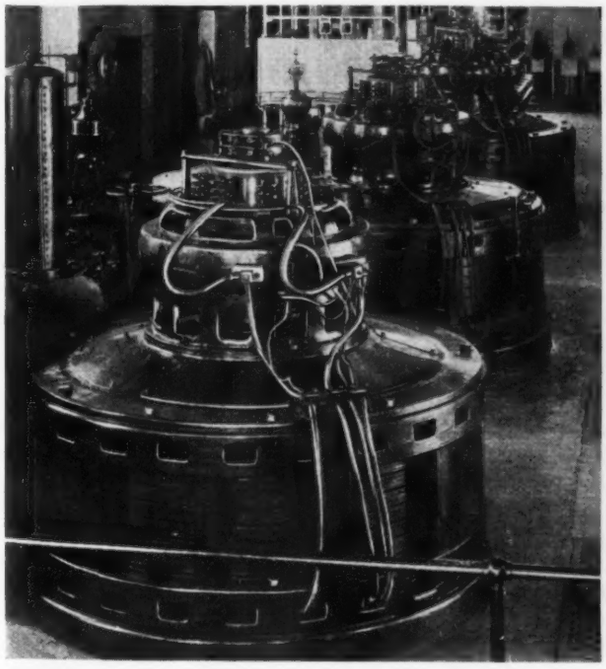
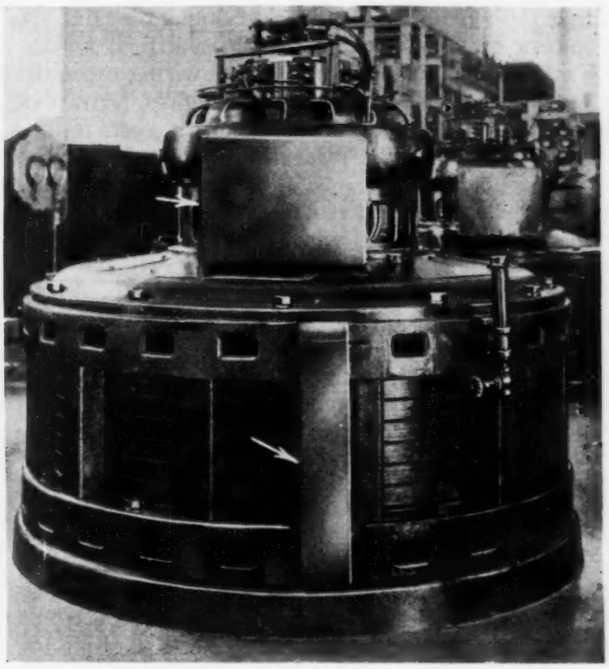
Modernizing Generator Connections

By FRANCIS A. WESTBROOK

The present being a time when all kinds of plant improvements are advocated in order to keep skilled help on the payroll and to key up all departments to the highest practicable degree of efficiency, it is interesting to take note of some of the things that are being done. Sometimes the expenditures of substantial sums are involved in such plant improvements, but here is one which cost practically nothing except for labor.

While much new equipment is needed in many plants of all kinds, and this is undoubtedly an excellent time to do such work for obvious reasons, there is a great deal that can be done of the kind illustrated. It at least gives employment to some of the skilled help and improves conditions to a decidedly worth while extent. With the Vermont Marble Company this is just an example chosen from among many improvements made during the depression.





Before and after modernizing

Until very recently the generator leads on some turbo-generators at Proctor, Vt., were all exposed. The head of the electrical department of the company had been intending to do something about this for some time, but when the numerous and widely scattered activities of the company were in full swing there was too much routine work to attend to anything except essentials. When the work slackened it became possible to care for many details of this kind. The leads were disconnected, bunched together and placed in sheet metal boxes made in the company's shop. By comparing the two illustrations it will be seen that at certain points, where it was possible, the leads were rerun through the inside of the generator casing. With the new arrangement it will be seen that a much neater appearance is obtained, but more important, the possibilities of service interruptions and accidents are reduced.

Saving Dollars by Wiring Sense

By E. A. BRAND
Engineer, Codes and Regulations
Niagara Hudson Power Corporation

HOW can dollars be saved in the wiring installation by spending more money? That sounds like a paradox, but it can be done. First of all, we must differentiate between installation practice and design practice. We must abandon the mistaken notion that the cheapest installation is one completed at the lowest original cost; that No. 14 wire should be used on branch circuits because it may be a fraction of a cent cheaper per foot than No. 12 wire; that an inspection certificate is the criterion of a satisfactory wiring installation. We take issue with those who feel that 2 watts per square foot in copper capacity represents the accepted standard with which a wiring installation in a modern building should conform.

Wiring by itself is useless. It is only a road to carry electrical traffic, but just as the system of state and county highways in this country had to be redesigned and rebuilt with the advent of the automobile, so the character and requirements of building wiring installations have changed during the past ten or fifteen years, with the advent of modern illumination standards and the development of widely varied uses of electrical service.

The modern building requires higher wiring capacities than ever before. But it is gratifying to learn that doubling the capacity does not double the cost, *if it is provided initially and not piecemeal as rewiring during the building life.*

To test this statement, estimates were secured from reputable contractors on wiring the "Brown Annex Building," bidding on the same specifications. Six conditions or systems were covered, namely, wattages per outlet of 100, 150, 200, 300 and 500 respectively, with a maximum of 2 per cent voltage drop, and a wattage per outlet of 300 watts with wiring merely to meet the National Electrical Code standards and irrespective of the voltage drop. (NOTE—*It is not sound specification practice to have the contractor determine the size of copper to be installed, on the basis of voltage drop. Sizes should be determined for him. But in this instance we wanted his estimate on sizes required to meet a maximum voltage drop condition.*) Table I summarizes the estimates.

The figures are averages of the bids received. It will be noted that a 50 per cent capacity increase from 100 watts to 150 watts per outlet increased the wiring cost only 6.6 per cent; that tripling the capacity cost only 36 per cent more, while 500 watts per outlet capacity with 2 per cent drop in place of 100 watts per outlet capacity raised the bid only 66.6 per cent.

Two questions may arise. Does it pay to consider feeder and circuit losses, or, in other words, voltage drop in the design, and why wire for, say, 500 watts when the owner or tenant thinks he wants 200-watt lamps only?

First let us examine the two installations with 300-watt lamps somewhat more closely. The average number of circuits for these systems 4 and 6 are 24, with four outlets per circuit. For system 4 with the voltage drop limited to 2 per cent, No. 10 was the average wire size used in the estimates. For system 6, meeting merely National Electrical Code requirements, No. 14 was used in the estimates. The average length of the 24 circuits is approximately 75 ft., or 150 ft. of wire. We will assume that the lamps burn five hours per day for 300 days, or 1,500 hours per year.

On the basis of four 300-watt lamps operating at 120 volts (not entirely a true assumption because of voltage drop) the current consumption per circuit is 10 amp. We will assume, in other words, that the kilowatt-hour consumption of both systems is the same. We find

Table I—Cost of Rough Wiring "Brown Annex Building"

Total number of outlets, 96. Systems 1 — 5, limit of 2 per cent voltage drop; system 6, no voltage drop limit, N. E. C. requirements only

System	Wattage per Outlet	Cost to Owner for Complete Job	Cost per Outlet	Per Cent Increase in Cost Over System 1
1	100	$542	$5.64	....
2	150	578	6.03	6.6
3	200	692	7.22	27.6
4	300	737	7.68	36.0
5	500	903	9.42	66.6
6	300	626	6.52	....

that the resistance of 150 ft. of No. 14 wire used per circuit in system 6 is 0.386 ohm. From the above we calculate that the wattage lost in heating the wire (I^2R loss) is 38.6 watts. Hence the yearly loss is 1,500 hours $\times$ 38.6 watts $=$ 58 kw.-hr. Similarly the resistance of 150 ft. of No. 10 wire of system 4 is 0.153 ohm, the I^2R loss in the conductor is 15.3 watts, which for 1,500 hours use per year amounts to 23 kw.-hr.

By using No. 10 instead of No. 14 wire we convert 35 kw.-hr. per year from useless heating losses into useful illumination. At a rate of 4 cents per kilowatt-hour this means a direct gain of $1.40 per circuit per year. For the total of 24 circuits the gain aggregates $33.60 per year.

It is usually considered economical to make an additional investment if it will pay for itself in approximately six years. On that basis, considering merely this item of branch circuit losses versus useful light, we could afford to spend between $150 and $200 to gain $33.60 in illumination per year.

Referring to the tabulation, you will note that the cost of the 300-watt installation meeting merely Code requirements is $626, while the cost of the complete 300-watt installation with 2 per cent voltage drop is $737, a difference of only $111. Certainly very much worth while. That is one way to save money by wiring sense, and

remember that the corresponding reduction in feeder losses due to heavier copper was not considered.

Effects of inadequacy on service expected

Now let us examine the problem from a slightly different angle and one that is possibly more readily understood. In the last analysis, the building owner is not buying kilowatt-hours, but is buying light, heat and power. We will assume he is buying illumination through the medium of incandescent lamps. What is the relation of voltage, wattage and light output?

When lamps are burned at 100 per cent rated voltage they deliver 100 per cent light and consume 100 per cent rated wattage. If, however, the voltage drops 10 per cent (90 per cent of normal), the light output drops 31 per cent (69 per cent normal), while the wattage consumption is reduced only 15 per cent (85 per cent normal). Hence the owner or tenant is paying for 16 per cent more light than he receives. From the above it can be demonstrated that the purchaser of the kilowatt-hours is paying an appreciably higher amount per unit of light quantity received, say per million lumen-hours, and that is what he is purchasing. A portion may be recovered by using lamps of lower voltage rating, but that has its limitations, and in the end he is paying the price of small copper. Again, wiring sense to save dollars can be applied and heavier copper *at a greater initial cost* is justified to increase the light output and reduce the losses. Remember that 10 per cent undervoltage operation means merely 115-volt lamps operating at 103.5 volts, a condition not infrequently encountered.

Similarly, undervoltage operation slows down the speed of cooking devices and heating elements to the point that in commercial and industrial establishments labor and production costs may increase due to the greater time required, and in the home we find the condition which is exemplified by the expression that "it takes all morning to cook breakfast." About a year ago our company conducted tests on 230-volt heating elements of electric ranges to determine the effect of operation on a 120/208-volt network system instead of the 120/240-volt radial system. Table II presents a few of the results.

Table II—Heating Performance With Undervoltage

Surface Units	Operated at 240 Volts	Operated at 208 Volts	Increased Time Required by Undervoltage Operation, Per Cent
1,000-Watt, 230-Volt			
Minutes to boil 2 qt. water	18.6	27.9	50.5
Watt-hours consumed	324	348	....
1,200-Watt, 230-Volt			
Minutes to boil 2 qt. water	13.2	17.8	34.2
Watt-hours consumed	283	287	....
Oven Units — Top and bottom, Each 1,500-Watt, 230-Volt			
Minutes to heat oven to 500 deg. F.	16.25	21.8	34
Watt-hours consumed	924	975	

Translated into commercial or industrial establishments the increased time required by such undervoltage operation means higher costs, while in the home it means dissatisfaction.

Why the future is important

Standards of electrical utilization are not static. The initial electrical use is merely the starting point. Buildings constructed in 1910 still have twenty to thirty years additional life, but little reflection is needed to realize that electrical utilization in 1933 is on a plane far above that of twenty years ago. The degree to which electricity is used increases steadily; levels of lighting are continually on the up-grade; new applications are constantly being developed. In addition the use made of building

Some Requirements of the Specifications

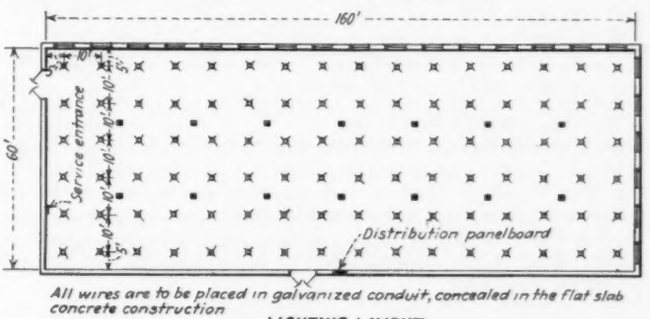
1. **Electric Service Entrance**—A fused safety service switch with proper meter loop and equipment must be installed at the entrance by electrical contractor.

2. **Feeder Wires**—A three-wire, single-phase, 115-230-volt feeder shall be installed from service entrance to distribution panelboard. In computing size of feeder wire, assume a load for each of two unconnected branch circuits equal to the load carried by each of the connected circuits.

3. **Distribution Panelboard**—A dead-front double-door distribution panelboard, 115-230 volt, shall be installed flush with wall with a 30-amp., single-pole toggle switch and plug fuse for each branch circuit, and two unconnected switches for future circuits.

4. **Voltage Drop and Size of Conductors**—All conductors must be of such size that under full-load conditions the voltage drop between panelboard and outlets will not exceed 2 volts. The voltage drop in main three-wire feeder should not exceed 2 volts when all circuits, including the present two extras, are connected.

5. **Cost Estimates**—For furnishing all material and installing job complete from service entrance to outlet boxes. Assume 100 per cent load factor on all circuits for six conditions as follows: (1) Outlets equipped with 100-watt lamps; (2) 150-watt lamps; (3) 200-watt lamps; (4) 300-watt lamps; (5) 500-watt lamps; (6) 300-watt lamps, disregarding entirely the 2-volt maximum drop, and all other definite specifications in paragraphs 2 to 4, inclusive, except that conductors must be placed in iron pipe conduit concealed in concrete and the work must at least meet the requirements of the National Electrical Code.



All wires are to be placed in galvanized conduit, concealed in the flat slab concrete construction

LIGHTING LAYOUT

Average of Estimates Submitted for Wiring

Average labor rate per hour = $1.50. Average per cent overhead and profit assumed = 20% + 10%

Wattage per Outlet	Outlets per Circuit	No. of Branch Circuits	Three-Wire Feeder*	Typical Branch-Circuit Wire Sizes† Panelboard to Bays A	B	C	D	E	F	Cost to Owner for Complete Jobs Material	Labor	Total
(1) 100	8	12	No. 2	14	12/14	12/14	12/14	12	12	$291	$251	$542
(2) 150	8	12	1	12/14	12/14	10/14	10/12	10/12	10/12	317	261	578
(3) 200	4	24	1/0	12/14	12/14	10/14	10/12	10/12	10/12	394	298	692
(4) 300	4	24	3/0	12	12	12	10/12	8/12	8/12	419	318	737
(5) 500	3	32	250,000 cm.	12	10/12	10/12	8/12	8/12	8/12	550	353	903
(6) 300	4	24	1/0	14	14	14	14	14	14	355	271	626

* Feeder wire size allows capacity for two unconnected circuits.

† Where two branch-circuit wire sizes are shown the larger is for the run between the panel and first outlet and the smaller for use between outlets.

space may change over night. The general office is occupied by a dentist or a beauty parlor; the woman's specialty shop becomes a drug store with a soda fountain and lunch counter; the space originally intended for storage or rough manufacturing is converted into an inspection or fine manufacturing department.

Apparently the designer is faced with the problem of maintaining the building electrically modern, particularly where steel and concrete construction is encountered. In that case it is difficult and expensive to rewire, and in some cases it is impossible to do so without marring the architecture of the structure.

If the building becomes obsolete electrically, tenants may leave or demand reduced rentals; fuse maintenance troubles increase, and if an attempt is made to keep pace with increasing lighting standards in an effort at electrical modernization excessive feeder and circuit losses are encountered, with the unfavorable results mentioned previously.

Field investigations support these statements. Last year managers of office buildings throughout the country were contacted* and asked certain questions concerning the wiring installations of their buildings. Among the questions asked and answers received were those shown in Table III.

Guides to adequacy

To insure a sound wiring investment more is required than merely spotting outlets on the floor plan and specifying wiring in accordance with the National Electrical Code and an inspection certificate. Then how to go about it? It is impracticable to discuss here all details of wiring design affecting residence, commercial and industrial structures. Certain guides, however, have been prepared to aid the designer and they can be made to serve the same purpose in this field that the National Electrical Code does in the field of installation. Two are products of the National Electric Light Association and a third was prepared by a committee on which were represented eight national electrical trade associations. These guides cover,

1. Adequacy wiring standards for residence buildings,
2. Minimum specification for adequate wiring of lighting circuits in commercial and public structures,
3. Minimum specification for adequate wiring of lighting circuits in industrial structures.

All three standards call for No. 12 A.W.G. conductors for branch circuit work. In addition the commercial and the industrial specifications require No. 10 wire from the panelboard to the first outlet on lighting circuits if this run exceeds 50 ft. and No. 10 wire from panelboard to first outlet on plug circuits if this run exceeds 100 ft. Lighting outlets and convenience outlets must be on separate circuits in commercial, public and industrial buildings.

In commercial and public buildings there must be one lighting circuit for each 400 sq.ft. of rentable or work space and one lighting circuit for each 800 sq.ft. of non-rentable or non-producing area; in other words, capacities of about 4 watts and 2 watts per square foot respectively. In certain spaces specifically listed 8 watts per square foot are called for. Panelboards are to contain one spare position for each five active circuits and service and feeder conduits are to be of such size that the originally installed conductors can be replaced with others of 50 per cent greater capacity. Initially, the service and feeders must be capable of supplying 7½ amp. to each 15 amp. circuit position. Show windows are to have one window-lighting circuit for each 5 linear feet of plate glass; in other words, 300 watts per running foot capacity, and a 1-in. conduit is to be carried to a suitable location for an electric sign. Circuits are provided for showcase lighting and convenience outlets in plenty are called for.

The standards for industrial structures also specify the number of lighting branch circuits on the basis of floor area, capacities varying from about 1½ watts per square foot to 8 watts per square foot, depending on the use of the space, whether material storage, rough, medium or fine work. Convenience outlet circuits are similarly specified, with one outlet per bay and No. 10 or No. 8 wire if devices in excess of 500-watt rating are to be connected. Branch circuit conduits must be of such size as to carry an additional circuit, and duplicate empty conduits are to be run for feeders, or sleeves are to be installed in floors and partitions.

The residence wiring standards call for a switched ceiling lighting outlet in every active room or space, duplex convenience outlets for every 12 ft. of wall space in active rooms, with at least one in every wall space 3 ft. or more in length, and three-way switches for garage, stairways and rooms with main entrances more than 12 ft. apart. Wiring is provided for range, water heater, bathroom heaters and furnace room. One lighting and convenience outlet circuit must be provided for every 500 sq.ft. of floor space, with two extra convenience outlet circuits for dining room, kitchen and laundry, where the heaviest appliance use occurs.

The minimum entrance capacity is three No. 6 conductors or equivalent, and for homes exceeding the minimum capacity requirements the entrance wire size is based on 2 watts per square foot for lighting plus 1,000 watts for small appliances, plus the rating of heavy-duty appliances. A factor is applied to the last-named item if approved by the inspection bureau.

These requirements make for adequacy, not merely as we know electrical use today, but with an eye to future additional demand.

Correct use of the standards presupposes that the designer will determine the wire sizes required through-

*N.E.L.A. commercial and industrial lighting committee.

*Table III—Factors That Lead to Wiring Inadequacy**

A—Report on eleven buildings inadequately wired and later rewired:

Question	Answer	
What was the principal reason for this alteration program?	Tenant demands	7
	Underwriters' inspection	3
	Modernization	3
What was the approximate cost of the alteration?	High	$40,000
	Low	3,200
	Average	14,460
How much could have been saved had the final wiring installation been made originally during construction of the building?	Highest saving that would have resulted	$25,000
	Lowest	1,200
	Average	9,600
	Not known	5

The amounts ranging from $1,200 to $25,000 could have been saved by anticipating the natural growth in electrical demand during building life and preparing for it in the original wiring installation.

B—Report on eight buildings with wiring originally inadequate and with the conditions still unremedied:

Question	Answer	Cases
What temporary rearrangements have been made to avoid overheating hazards?	Small wiring changes	3
	Overfusing	2
	Loss of tenants	2
	No changes	3
	No report	3
What are the tenants' complaints in regard to the electric system?	Want modern lighting	4
	Cannot use appliances	2
	Poor voltage	1
	No complaint	1

C—Report on fourteen buildings in which the initial wiring was found adequate

Question	Answer
Was adequate wiring influential in	
A. Obtaining higher rentals?	Yes, 5; No, 5; Doubtful, 2
B. Obtaining quicker rental of space?	Yes, 8; No, 4; Doubtful, 1
C. Keeping tenants satisfied?	Yes, 10; No, 1; Doubtful, 2
D. Lowering turnover of tenants?	Yes, 11; No, 1; Doubtful, 1

out the job and will actually specify them. It is only when sound design, as exemplified by the standards mentioned, is combined with a rigid set of specifications which specifically call for wire sizes, detail the outlets per circuit and specify panelboard and duct sizes in detail, that a complete, economical and modern wiring installation is assured.

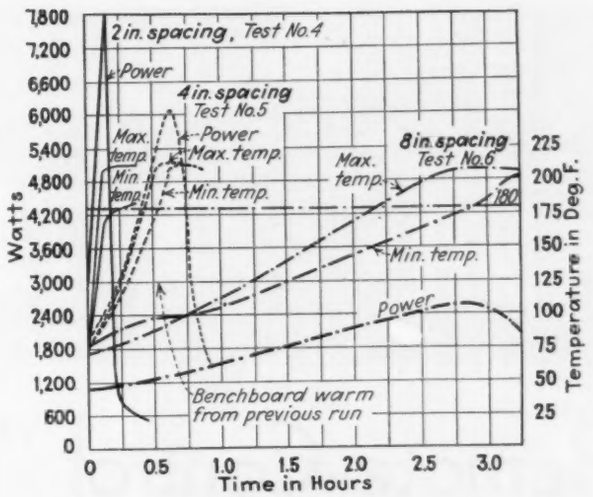
▼

Electric Soil Sterilization Found Promising

Results of studies to determine the practicability of sterilizing soil by conducting electricity through it are now available from the National Rural Electric Project, College Park, Maryland. In general it has been concluded that the method may be used with reasonable safety and satisfaction if specially built sterilizing boxes are used, although the method is far from foolproof at the present time for general application. However, A. V. Krewatch and G. W. Kable express the belief that this method offers as great possibilities as, or greater than, other methods.

The method involved was advocated by the Puget Sound Power & Light Company and utilizes parallel sheet-metal plates inserted vertically in the soil, with successive plates connected to opposite sides of a 230-volt circuit. The power required depends on the moisture and soluble salts in the soil and on the soil contact obtained. The effect of different spacings on the power demands and rate of rise of temperatures is indicated for a specific case in the chart and results of thirteen tests with different conditions are shown in the table. When power is applied it will be observed that the demand rises and then drops off as the moisture is driven off, the peak occurring more promptly with close electrode spacing.

In most cases the maximum temperature obtained was approximately 212 deg. F. and the sterilizing effect was practically the same as produced by steam, except that there was no condensation in soil to cause puddling. With 4, 6 and 8-in. spacings the maximum differences in temperature obtained in different parts of the soil were 50 deg., while with a 2-in. spacing the differential attained 85 deg. Covering the sterilizing boxes saved heat, held in the steam, and retarded the drying action at the electrode contacts. Lumps of dry soil when mixed with moist soil lag in temperature rise. When the soil is very moist or contains considerable soil solution it may be necessary to limit the amount of soil treated if electrodes are too close together.



Effect of electrode spacing on power and temperature cycles

Based on using four electrode plates (38x6 in.) connected to 230 volts in silt loam soil 6 in. deep and initially containing 20 per cent moisture. The point at which the minimum temperature curve crosses the 180 deg. line indicates when the entire body of soil reaches a temperature of 180 deg. or higher. The power could have been cut off at this time.

Drying out of the soil at the plates was found to be the greatest deterrent to the soil-resistance method, especially in low-moisture soils. Stirring or moistening the soil re-establishes contact, but involves labor. To secure good soil contact initially it is suggested that the soil be chopped or worked into contact with the electrodes with a trowel.

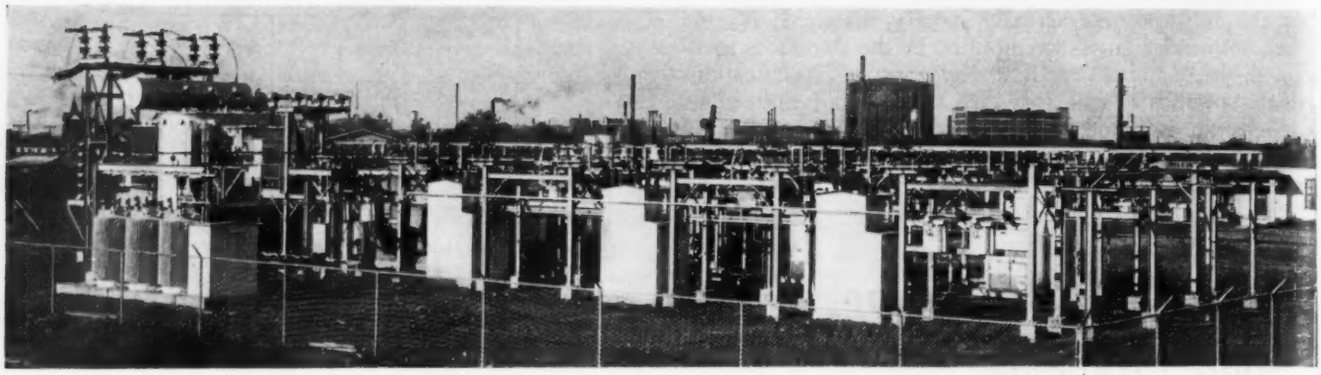
Sterilization of soil in grounded beds was found impractical when power is supplied from a grounded neutral circuit, because leakage to grounds may vary from 20 to 75 per cent of the total current, the drying effect at the plates is accentuated and conduction losses of heat to the surrounding soil is large.

Energy consumption ranged from 25 to 30 kw.-hr. per cubic yard in the box sterilizer, 30 to 40 kw.-hr. in the bench soil and 40 to 50 kw.-hr. for grounded beds when the soil was raised to between 180 and 211 deg. F.

Results of Thirteen Tests with Electric Soil Sterilization

Bench used was 38 in. wide; soil, 6 in. deep; electrode plates, 38x6 in. Items in eighth column preceded by asterisks are explained in last column.

Test No.	Where	Temperature: Start	End: High	End: Low	Room Avg.	Soil: Kind	Soil: Per Cent Water	Number Plates	Plate Spacing, In.	Time in Hrs., Minutes to: Max. Power	Max. Temp.	Power Cut Off	Watts at Approximately 230 Volts: Start	Max.	Stop	Remarks
1	Bench	66	71	69	68	Silt loam	13.5	9	8	0:20	0:20	0:20	850	1,050	1,050	Insufficient moisture.
2	Bench	70	211	153	71	Silt loam	13.5	12	6	2:27	3:10	3:21	2,112	4,900	1,800	All soil did not reach 180 deg.
3	Bench	63	211	183	72	Silt loam	20.0	9	8	2:12	2:42	3:12	2,520	5,740	2,570	Successful.
4	Bench	70	212	182	73	Silt loam	20.0	4	2	0:08	0:08	0:22	3,120	7,770	624	Successful.
5	Bench	71	212	211	73	Silt loam	20.0	4	4	0:38	0:34	0:53	1,920	6,075	1,800	Successful.
6	Bench	72	211	199	75	Silt loam	20.0	4	8	2:45	2:45	3:30	1,008	2,618	1,705	Successful.
7	Bench	66	211	181	78	Silt loam	18.5	5	Irregular 2 to 6	0:33	0:23	3:01	2,472	5,136	552	Eventually successful.
8	Bench	63	211	177	69	Silt loam	*4.4 *20.3 *20.7	6	4 (Dry spots)	0:35	0:35	0:55	3,192	7,152	1,200	*Dry lumps. *Set 24 hours. *Wetted and put in.
9	Bench	61	*211 *201	*207 *145	72	Silt loam	20.0	9	6	0:35	0:35	1:11	2,496	6,960	1,344	*Covered. *Uncovered.
10	Bench	68	211	183	71	Well rotted manure	54.2	5	2	0:12	0:12	0:22	2,488	7,440	720	Successful.
11	Bench	65	211.5	211	73	Sand	*13.7 * 2.0	6	2	0:28	0:26	1:16	2,112	6,528	1,072	*At start. *At stop.
12	Box	62	211	186	66	Sandy loam	16.8	6	6	0:45	1:00	1:15	3,435	8,160	1,392	Box 0.77 full.
13	Box	67	211	178	68	Sandy loam	13.6	6	6	1:05	1:15	1:25	3,648	9,624	4,704	Avg. max. in box 250 deg.



Remote-Control "Loop" Substation Reduces Investment

By R. M. STANLEY*

Byllesby Engineering & Management Corporation, Chicago

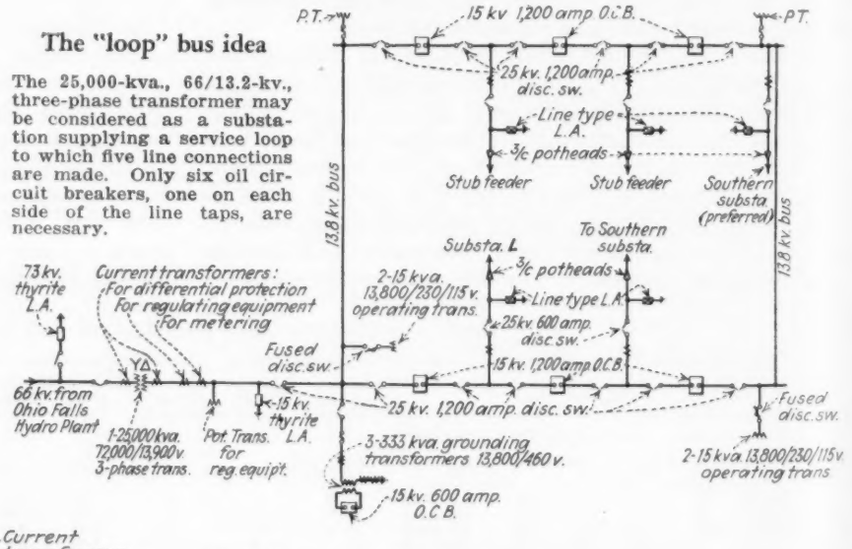
SCHEMES of remote or automatic control are usually thought of as deriving their economy from the elimination or reduction of operating labor. But this is not in all instances a complete statement of the case, nor, in a given instance, may it be true at all. More truly might it be said that remote or automatic control means a transference of labor from one place or from one function to another with the possibility of some reduction in the process. Frequently it may develop that the economy of such control arrangement lies much less in the labor consideration than in the opportunity afforded for savings in design and construction. A striking example of this economy aspect of remote control is exhibited by the Algonquin substation of the Louisville Gas & Electric Company. In this substation a conspicuous cost reduction was effected by removing the necessity for a large investment in a central switchboard, in a control house adequate for attendant operating labor, in an extensive and complex system of conduit and wiring and in instruments usually accepted as required for local operation.

Algonquin substation apparently proves that remote control and "loop" design make a happy combination from the cost standpoint. The latter feature is rather new, or, at least, it is not usual, so it is illustrated somewhat in detail. The energy is stepped down from 66 kv.

**This article was completed only a few days before Mr. Stanley's death, March 7, 1933.*

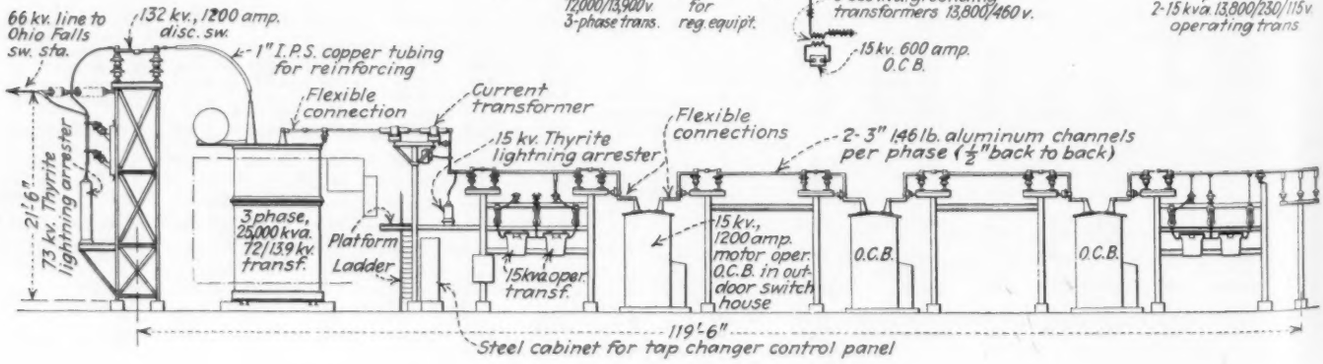
The "loop" bus idea

The 25,000-kva., 66/13.2-kv., three-phase transformer may be considered as a substation supplying a service loop to which five line connections are made. Only six oil circuit breakers, one on each side of the line taps, are necessary.


P.T.
15 kv 1,200 amp O.C.B.
P.T.
25 kv. 1,200 amp. disc. sw.
Line type L.A.
3/c potheads
Stub feeder
Stub feeder
Southern substa (preferred)
13.8 kv. bus
To Southern substa.
Substa. L
3/c potheads
Line type L.A.
25 kv. 600 amp. disc. sw.
15 kv. 1,200 amp O.C.B.
13.8 kv. bus
73 kv. thyrite L.A.
Current transformers: For differential protection For regulating equipment For metering
2-15 kv.a. 13,800/230/115 v. operating trans.
Fused disc. sw.
66 kv. from Ohio Falls Hydro Plant
1-25,000 kva. 72,000/13,900 v. 3-phase trans.
Pot. Trans. for reg. equip't.
15 kv. thyrite L.A.
25 kv. 1,200 amp. disc. sw.
Fused disc. sw.
3-333 kva. grounding transformers 13,800/460 v.
2-15 kva. 13,800/230/115 v. operating trans.
15 kv. 600 amp. O.C.B.

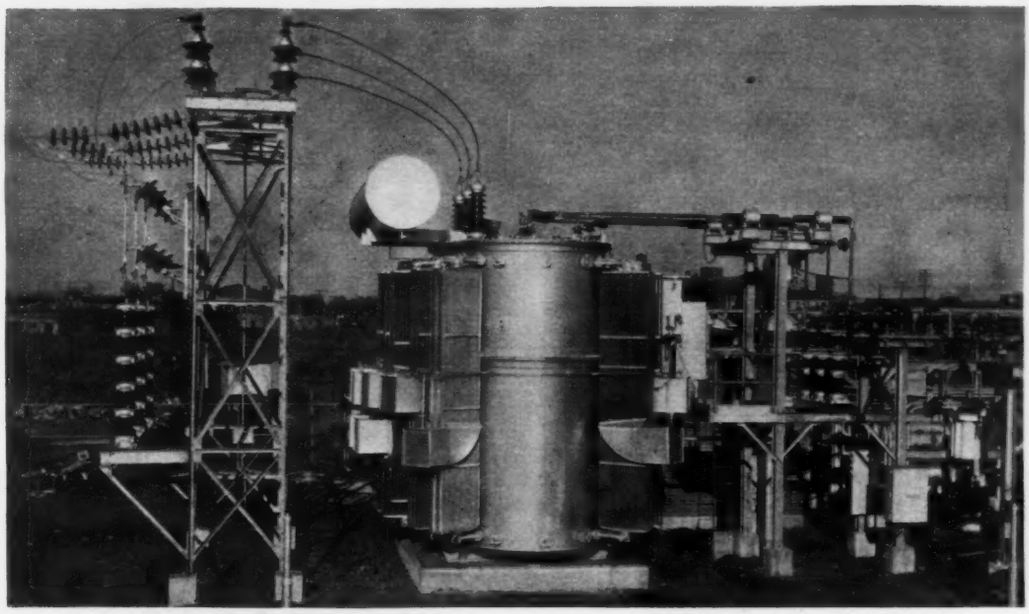
Three breakers on a side

The unit construction is apparent here. Each piece of major equipment stands on its own foundation with simple steel structures to carry the bus sections between them.


66 kv. line to Ohio Falls sw. sta.
132 kv., 1200 amp. disc. sw.
1" I.P.S. copper tubing for reinforcing
Flexible connection
Current transformer
15 kv. Thyrite lightning arrester
Flexible connections
2-3" 14.6 lb. aluminum channels per phase (½" back to back)
21'-6"
73 kv. Thyrite lightning arrester
3 phase, 25,000 kva. 72/13.9 kv. transf.
Platform Ladder
15 kva oper. transf.
15 kv., 1200 amp. motor oper. O.C.B. in outdoor switch house
O.C.B.
O.C.B.
119'-6"
Steel cabinet for tap changer control panel

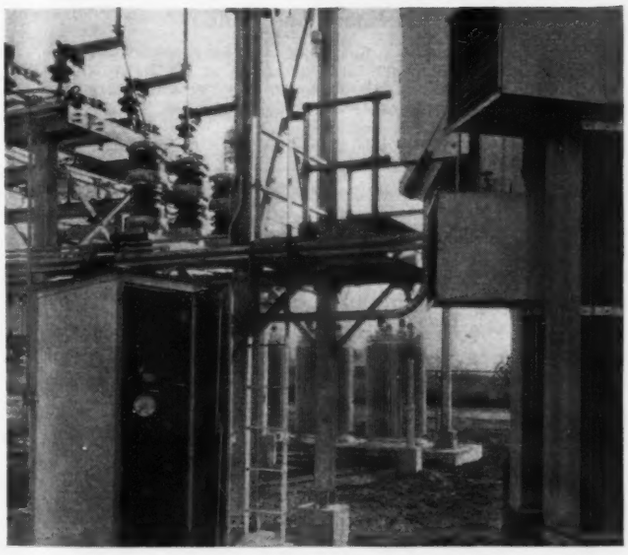
Serving the loop bus

The 25,000-kva., three-phase transformer is an oil-insulated, self-cooled unit with automatic air blowers for heavier loads. A supervised tap changer maintains the secondary voltage. Note close location of high- and low-voltage lightning arresters for maximum protection to transformer.



From transformer to substation bus

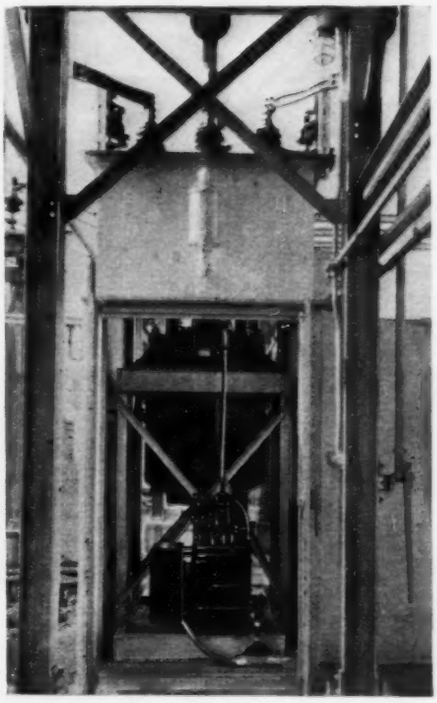
At the right are blower openings on the 66/13.2-kv. transformer. Background, center, is the bank of three 333-kva. transformers for grounding the delta 13.2-kv. bus. The cubicle at the left contains the supervised control for the tap changer.

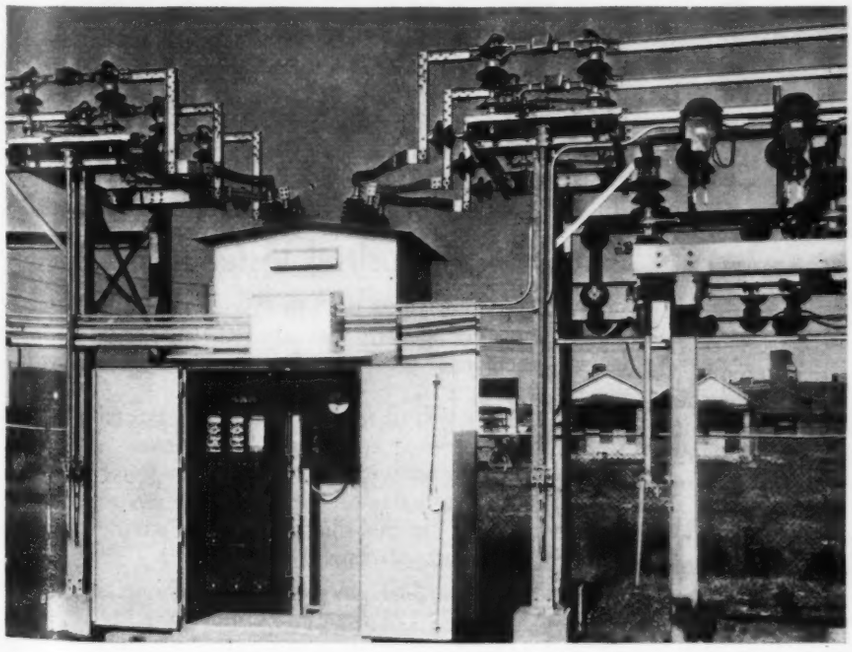


to 13.2 kv. and sent out on five lines to distribution substations. The Algonquin bus is developed exactly as if it were a service loop, with these five lines representing customer connections. This conception immensely simplified the design which was carried out in very close approximation of an actual service loop with line connections in unit structures independent of each other, and with the sections of bus between them, in more ways than one, closely comparable to an overhead line.

Breaker cubicle opened

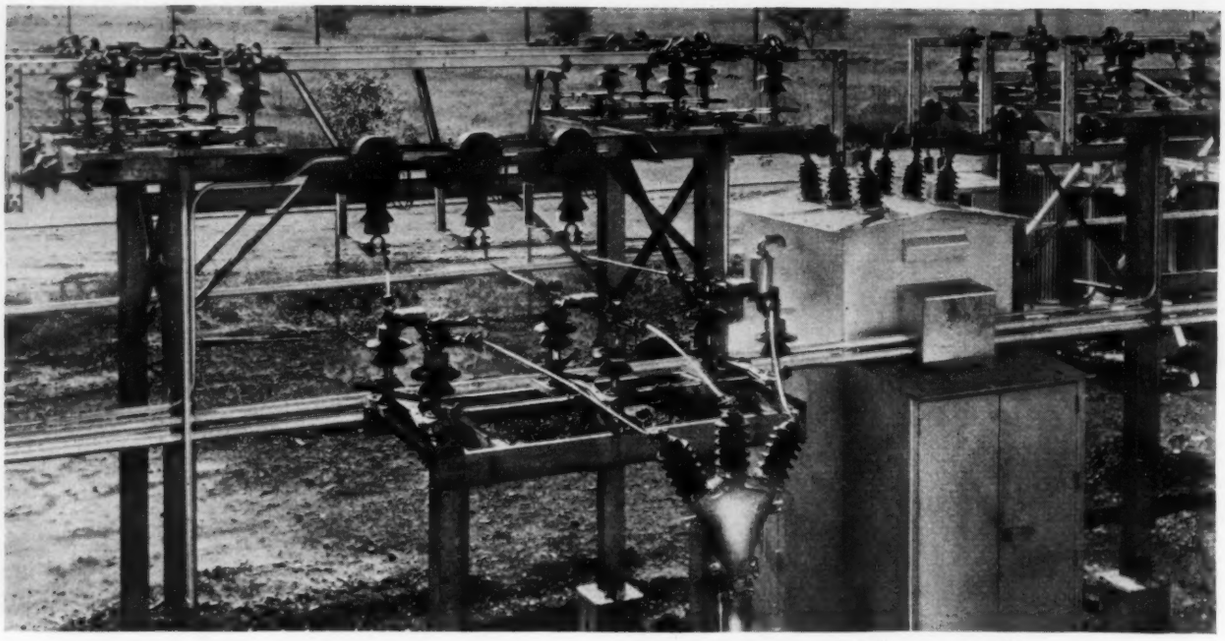
The supporting frame for the 1,200-amp. breaker is independent of the cubicle structure.





Unit breaker and control cubicle

From the aluminum channel buses flexible connections extend to terminals on roof of switch cubicle. In a separate compartment of the cubicle, doors open, are control devices associated with breaker and watt-hour meters for one of the adjacent outgoing lines.

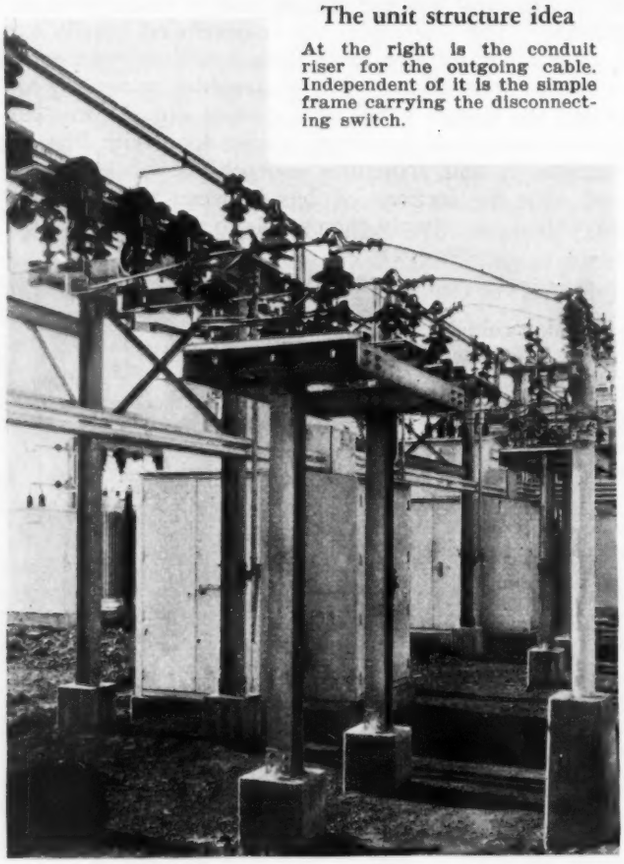


A line connection

This picture shows a detail of economy contributed by the aluminum channel bus. Because of its light weight it was possible to do without any intermediate bus supports between the disconnecting switches.

The unit structure idea

At the right is the conduit riser for the outgoing cable. Independent of it is the simple frame carrying the disconnecting switch.



The manner of operating the substation by the synchronous selector system is a refinement of the method used in the Ohio Falls hydro-electric station, and which was quite thoroughly described in the paper, "Three Years' Experience with Miniature Switchboard Supervisory Automatic Control," presented at the A.I.E.E. summer convention in 1932. Briefly stated, the scheme in the hydro station includes the location of individual control and switching equipments close to the machines, with only supervisory and impulse circuits running to the small central operating board. This idea of placing operating control apparatus close to its controlled equipment appears in Algonquin substation, but the central operating point is more than 7 miles away in the system operator's office in the Waterside steam plant. Progress in supervisory and impulse control technique has been great since the hydro station installation was made, and where the supervisory currents in that job are measured in tenths of amperes, those in the Algonquin set-up are in milliamperes. This has allowed the use of much lighter construction and has refined the system considerably.

The "loop" bus design permitted extensive use of unit equipments with their concomitant saving of structural expense. Particularly are these savings apparent in foundations and steel, as is shown by the following figures. Of the total cost for equipment and material on the ground and for direct construction labor, the land was responsible for 6.75 per cent, the main transformer for 38.75 per cent, other electrical equipment and materials for 47 per cent, leaving only 7.5 per cent for foundations and steel.

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Savings in Industrial Installations*

"A 75-hp. motor was used to drive a large air duct system. The duct system was altered, individual blowers installed and the total load reduced to 15 hp., accomplishing the same result.

"In another plant motors with a total capacity of 1,400 hp. were used to drive dust-removal fans. The fans were equipped with blast gates, but these were not used. By closing gates on the ducts not in use and slowing down fans on the ducts in use a saving of $700 monthly was accomplished."

**From the power sales files of the Cleveland Electric Illuminating Company, cited by W. E. Benninghoff to Electrical Maintenance Engineers' Association at Electrical League of Cleveland.*

Sizes and Types of Electric Drives in Michigan Copper and Iron Mines

Reproduced from report of field survey included in "An Analysis of Electrical Equipment Used in the Copper and Iron Mines of Michigan," Vol. 6, No. 1, Bulletin of the Michigan College of Mines and Technology.

Mine	Power Supply		Hoisting Equipment									Air Compressors			Pumps			Haulage	D. C. Supply					
				Hoist Motors				Drum												Motor			Generator	
	Trans. Line Voltage	Trans. Cap., Kva.	Type	Use	Hp.	Voltage	R.p.m.	Type	Dia. Ft.	Face, Ft.	Rope Speed, Ft./Min.	Hp.	Lb./Sq.In.	Cu.Ft. per Min.	Hp.	Capacity, Gal./Min.	Head		Type	Hp.	Volts	R.p.m.	Volts	Kw
A	33,000	17,000	W-L[1]	Skip	2,300	600	80	D. cyl.	10	10	2,500	3–450	87	.....	3–450	Total	2,200	D. C.	Ind. M-G	149		875	275	100
			Ind.	Cage	600	2,200	355	D. cyl.	10	10	.....					750			Ind. M-G	100		1,160	275	
																			Ind. M-G	50		1,160	125	35
																			Ind. M-G	150	2,200	870	250	100
																			Converter			1,200	275	300
B	33,000	2,000	I-W-L[2]	Skip	1,650	525	80	D. cyl.	10	6	2,500	463	105	3,000	500	750	2,000	D. C.	Syn. M-G.	220	2,200	1,200	275	150
			Ind.	Cage	400	2,200	352	D. cyl.	10	6	1,200	400	105	1,900	200	300	.....					1,200	275	
															125	200	.....							
C	33,000		I-W-L[3]	Skip	500	525	60					325			350	800		D. C.	Syn. M-G	220	2,300	1,200	275	200
				Cage	200	200	250					438			350	900			Syn. M-G		2,200	1,200		150
D	13,200	1,000	Ind.	Skip	450	2,200	441	D. cyl.	10	8.33	1,200	2–700	90	3,200	450	1,000	1,000	D. C.	2-Ind.M-G		2,200	1,200	250	90
			Ind.	Cage	300	2,200	441	D. cyl.	10	8.33					2– 75	1,000	180							
															3–350	650	1,600							
E			Ind.	Skip	450	2,080	300	S. cyl.	12	6.25	725													
				Cage	Same motor serves both skip & cage			S. cyl.	12	6.25	600													
								Counter weight on cone.																
F	13,200	2,625													2-1050	3,400	1,000	D. C.	Ind. M-G	300	440	700	225/250	
															350	.....	1,000							
															2–450	3,400	435							
															150	.....	435							
G	13,200	2,625										2–400	90	1,850	3–650	1,200	1,400	D. C.	Converter			1,200	250	100
H	6,600	600	Ind.	Skip	400	2,200	590	Cyl.	7	7	1,200	400			150	400		D. C.	Ind. M-G	150	2,200	1,175	275	100
				Cage	100	2,200	570	Cyl.	5	55	600				75	250								
I			Ind.	Skip	220	2,200	354	Cyl.	10	8.5	900	367	100	2,000	200	3,500	165	D. C.	Ind. M-G	115	2,200	1,175	275	75
			Ind.	Cage	200	2,200	450	Cyl.	8	7.5	800	220	100	1,600	150	3,000	165		Ind. M-G	112	2,200	1,175	250	75
															40	.....	165							
															300	5,000	251							
															50	250	.....							
															300	1,000	700							
															150	750	.....							
															20	150	142							
															30	275	.....							
															200	2,000	.....							
J			Ind.	Skip	600	2,200	435	Cyl.	10		1,200	417	85	2,500	2– 75	400	325	D. C.	Converter			1,800	250	
				Cage											100	600	325							
K			Ind.	Skip	500	2,200	600	Cyl.	10	6	1,000	2–440	80–85	2,500					Syn. M-G	150	2,200	900		
												175							Syn. M-G	100	275	.....		
																				215	2,200	600		
L	2,300	1,500	Ind.	Skip	2–400	2,200	353	S. cyl.	10	7	940		80–85	2,600					Converter			1,200	275	60
			Ind.	Cage	400	2,200	353	S. cyl.	10	7	625													
M	22,000	2,500	Ind.	Skip	1,500	2,200	355	Cyl.	12	17.6	1,500													
				Cage	500	2,200	350	Cyl.	12	17.6	1,000													
N	11,000	1,500													2–250	250	3,000	D. C.	Syn. M-G		2,200		250	200
															2– 35	80			M-G		2,200		250	100
																			M-G		2,200		250	100
																			M-G		2,200		250	50
O	31,000																	A. C.						
P	2,300	450	W-L[4]	Skip	500	250	700	Cyl.	5	6	1,450	Hoisting												
											1,725	Lowering												

[1]Ward-Leonard drive. Generator, 2,000 kw., 600 volts, 514 r.p.m., driven by 2,200-hp., 2,200-volt synchronous motor.

[2]Ilgner-Ward-Leonard drive. Generator, 1,300 kw., 525 volts, 505 r.p.m. with 21-kw., 260-volt exciter driven by 1,300-hp., 2,200-volt induction motor with 46-ton, 13-ft. flywheel.

[3]Ilgner-Ward-Leonard drive. Generator for skip motor, 400 kw., 475 volts. Generator for cage motor, 200 kw., 200 volts. Common exciter, 35 kw., 250 volts. Both generators driven by induction motor, 800 hp., 2,200 volts, 885 r.p.m. mean speed, with 7½-ft. flywheel.

[4]Ward-Leonard drive. Generator, 400 kw., 250 volts, with 9-kw., 125-volt exciter. Driven by 500-hp., 440-volt, 750-r.p.m., synchronous motor.

Stage Lighting Technique Eliminates Window Glare

Daylight reflections in show windows can be eliminated by applying the principles of theatrical lighting. The accompanying illustrations of a display window of the Milwaukee Furniture Company on the sunny side of a San Francisco street show the effects of proper and improper illumination.

Window lighting practice ordinarily concentrates a border of reflectors around the window, which in daylight has the effect of throwing most of the light to the floor and leaving the rear wall improperly illuminated. As a result it is dark enough to make the front glass opaque to the passerby, reflecting all street images rather than the merchandise on display within.

The installation consists of three metal wiring gutters or strips, 9 ft. long to each window. The windows are 11 x 13 ft. x 10 ft. high. To the strip are fastened a new adjustable housing permitting complete swing of the 200-watt reflectors in either a vertical or horizontal plane a full 180 deg. This housing, completely metal clad, meets Underwriters' requirements, which usually restricts reflectors to rigid installation and can be used on almost any make of reflector.

Five feet from the rear wall a row of three 200-watt reflectors are mounted on the strip, each of which is individually directed, as a stage electrician would direct spots or floods, upon the areas needing the concentration of light to kill street reflections. The middle row has four 200-watt reflectors concentrated on merchandise at the rear of the window and the front row, at the window, where usually the entire installation is concentrated, has but four 200-watt reflectors illuminating the foreground.

To conceal the reflectors, another stage trick was used, namely, valances. An extra 200-watt reflector, using the same flexible housing, mounted on an outlet box with a separate switch, is used to keep the window lighted after the regular lighting has been shut off at night. Thus each window has twelve 200-watt reflectors, each individually directed.

The adjustable housing, metal wiring strip and reflectors are a development of the Wuelker Reflector Lighting Corporation of San Francisco.

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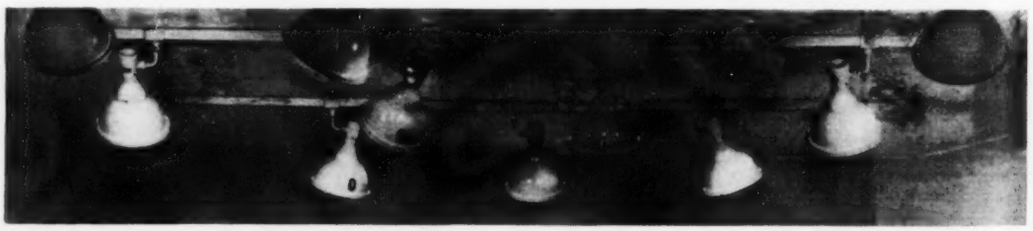
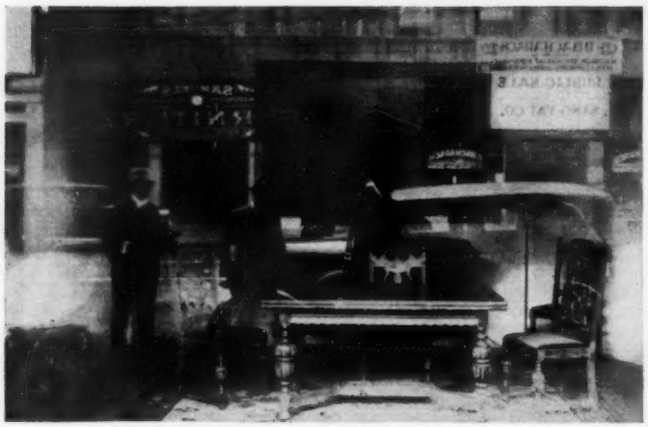
Portable Demonstration of Air Conditioning

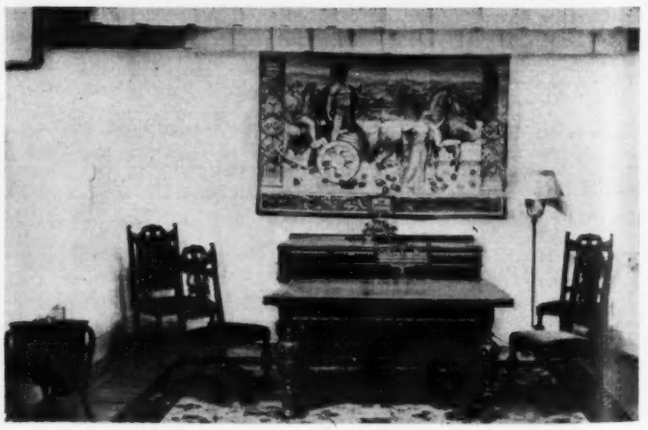
Air conditioning as applied to the home is so new that it will require much practical demonstration before any large volume of sales can be realized. It has been noted that even the most indifferent prospect for air conditioning can be won over to enthusiastic support by actually experiencing the physical comfort and restfulness of cool and drier air during hot and humid weather. T. R. Dobson, Penn Central Light & Power Company, reports*: "It has been suggested that a number of demonstration units be maintained which can be mounted on low-wheeled trucks or skids for temporary location in a prospective customer's home, with water and electrical connections made by hose and other temporary means. The period of demonstration need not be long, or, in any case, over a week. If the customer is convinced of the satisfactory operation of the equipment and can be sold, the temporary installation is removed and a permanent one made. The temporary equipment can then be used for further demonstration at some other location. I have been advised by one of the leading manufacturers of air-conditioning equipment that such portable units will be available in the very near future and that the cost of making temporary connections will be less than one-fourth of the permanent installation costs, in all but extremely difficult cases."

**Before sales conference of Pennsylvania Electric Association.*



Overhead lighting showing the adjustable housing for the reflectors and the reflectors and the metal wiring strip





Street reflections in a display window on the ordinary sunny day without internal illumination and the same window properly illuminated

How to Sell Power

By J. F. GASKILL*
Manager Industrial Sales Philadelphia Electric Company

Local market analysis.
Co-operation with other sales agencies.
The use of trained but unspecialized salesmen.
Examples of success.

IT IS my belief that in selling kilowatt-hours for industrial and large commercial use we have lost sight of the fact that in marketing kilowatt-hours we are selling something not only entirely different in itself but also different in that the fundamental principles of disposing of the product are entirely unique and outside the experience of any other sales field. This difference is so extraordinary that I would like to call attention to the main points of variance. These are:

1. Our ability to sell kilowatt-hours depends entirely on the success of other people in inventing, designing, manufacturing and selling utilization equipment.
2. We must sell both retail and wholesale, without the intervention of any middleman.
3. Our sales are confined to a small section of the country and are, therefore, dependent upon a highly concentrated local market.
4. Kilowatt-hours cannot be stored by our customers or by ourselves to smooth out variations in requirements. Rates must, therefore, vary the unit price with usage. On this account the original sale must be accurately developed in so far as it fits the customer's requirements as to service and cost. Failure results in expensive efforts to hold restless customers, bad advertising and loss of confidence in our knowledge of our business. Other consumption goods may repair a price mistake with the next sale. It is impossible for us to change our tariff as easily as that.

If we analyze the situation I believe we can agree that in industrial and large commercial work there are two fundamental conditions to be met before we can say that we have developed a successful sales organization and method of sales. These conditions are:

1. Since our product in itself carries no direct sales appeal our primary sales job is to sell some one the idea of using our product through equipment made and sold by some one other than ourselves.
2. Due to the local character of our market we, more than any other sales organization, are confronted with the necessity of disposing of our product on a fact-finding basis in order that we may have a maximum number of transactions which meet the old definition that "a successful sale is one in which both parties profit." This means accurate knowledge of the market and accurate information as to the dollars and cents results of applying our product to that market.

Now if we consider the two conditions with which we are faced, we must admit that the usual type of sales organization will not fit the problem nor will the use of the generally accepted sales plans and methods meet the unusual market condition. Generally, if you want a man to sell hosiery you employ a man who knows hosiery and can sell it, and so with all the usual production units which are disposed of in the usual market. This same method has sometimes been used in employing power salesmen, with a complete disregard of the fact that we are engaged in selling an idea, so that some power sales organizations may have found themselves confronted with an unco-ordinated sales force, each of which was employed to sell a particular trade, such as the ice business, industrial heating, commercial cooking and baking, textile mills, silk mills, steel mills, etc. These men, not having been trained in the broader conception of the work of industrial sales, are sooner or later confronted by the completion of their job in their special field, only to find that the new fields which have come up while they were working on their specialty have been preempted by other individuals employed for an equally special purpose. This is discouraging to the individual, destructive of flexibility in handling the sales force and results, over a period of years, in a large force of men working for a nominal salary. This type of organization certainly does not fit the requirements of our fundamental conditions.

Do not use specialists

Since our sales effort in a particular field ultimately reaches a saturation point, if our rates are right and our selling good, our organization should be built so that we can attack the various subdivisions of our field, push them to saturation and then move the same force to another part of the field so as to avoid the necessity for continually employing new specialists and discarding or shelving older specialists who have outlived their usefulness in their particular field. This permits a fewer number of higher class, better paid men and makes for higher organization morale because of a broader knowledge and conception of the business by the individual salesman.

Such an organization uses all of its salesmen to sell all of the market on whatever application may be ripe for sales development. Under such a set-up there must be a minimum amount of office work and a minimum amount of handling of existing customers on trouble, service and complaint work by the salesmen, so that the development of this idea forces us to a section primarily devoted to the preparation of proposals, contracts, orders and all requests and follow-up of estimates on the engineering department for service installation, thereby relieving the salesmen of this work and insuring uniformity of procedure. Since the salesman is engaged in doing that which he was employed to do, namely, contacting and selling the market, he must also be backed up by a service division which keeps him supplied with engineering information on competitive jobs, formal reports compiled at his request and which also takes care of the complaint and trouble work and the host of inquiries which always develop among a large number of customers. In doing this work the service division becomes

**Abstract of paper presented at sales meeting of Pennsylvania Electric Association, Philadelphia.*

well qualified to analyze new applications as they come out and report on their availability for marketing. This can be done by a special promotional section of the service division. Incidentally, all phases of the work of the service division has, in our experience, been highly productive of new business leads.

In suggesting this form of organization I have not forgotten the attractive feature of assigning one salesman to handle a group of customers on any question which may develop. One-man contact is excellent, but if a market is to be developed such a system sooner or later forces the salesman to choose between his efforts to develop new business and the claims of the troubles of existing customers on his time. I do not believe that one-man control of a group of customers can be justified in the face of that fact.

In widely scattered plant locations in semi-rural districts some modification of the split-up of work must be made on the basis of time saved in transportation, but I have found this particular organization set-up to function just as satisfactorily in a scattered community as in a congested area, provided good judgment is used in applying the idea.

Using this kind of an organization and operating set-up the industrial sales department of the Philadelphia Electric Company contracted for, between January 1, 1928, and 1932, more than 700,000,000 kw.-hr. of new and additional industrial and large commercial business. This is exclusive of any railway, traction or utility load and represents a load equivalent to the total send-out of the company during the year 1919.

At the conclusion of 1931 the total air-conditioning load of the Philadelphia Electric Company system—industrial and commercial—was 8,204 kw. of demand and 16,620,000 kw.-hr. At the same time the industrial heating load amounted to 30,426 kw. of demand and 76,674,369 kw.-hr.

We feel that this performance justifies our confidence in the results which can be obtained by means of the sales-service type of organization which we have been discussing. We are particularly confident of this because of the fact that during the four-year period of intensive market development mentioned the power sales department, while set up for sales-service operation, was not organized to the point where the maximum benefits of the type of organization could be realized. In the fall and winter of 1931 it was decided that the department would be organized completely for the sale of gas, steam and electricity along the lines laid down in the earlier discussion in this paper.

We felt that this particular type of organization lends itself best to the satisfaction of the fundamental condition of co-operative sales to which we are forced by the fact that the sale of our product is dependent upon the design, manufacture and sale of something else by somebody else. In the past manufacturers have developed, manufactured, advertised and sold their equipment without definite co-ordination of their efforts with those of the central station. Spasmodic attempts of co-operation have been made, generally built upon the idea that the manufacturer should supply the advertising matter, after which the utility could supply the man-power for selling both the idea and the particular manufacturer's equipment. Due to the complication and the enormous diversity in industrial equipment, such methods have only been partially successful and have always led to considerable criticism by other manufacturers who felt that they were suffering unfair competition due to the co-operation of the utility with a single manufacturer in the particular campaign.

Place of manufacturer in sales

Outside of these discontinuous affairs the utility salesmen and the manufacturers' salesmen have gone merrily on their way attempting to sell their respective products, without much thought of concentrating and combining their sales efforts. Certainly in industrial work the utility sales department knows or should know its market better than any other. Certainly the manufacturer of industrial equipment, with all its complication and diversity, is in a better position to sell that equipment than the utility. Certainly a sales effort directed at the cream of the market, that part of the market which is most susceptible to sales pressure at a given time, cannot help but show better results if the utility selects that part of the market to be attacked, covers it by proper advertising, predicated on selling the idea of the application, and follows that advertising immediately by calls by its sales personnel and by pressure from the sales forces of the manufacturers on the good prospects developed by the advertising and sales calls of the utility.

Here we have a picture of each interested party in the transaction doing the thing which he has been doing before, but doing it at a planned time in a selected market in definite sequence of effort. This is in direct contrast to the former hit-and-miss method of advertising and unco-ordinated sales pressure of the utility and manufacturer. It also lends itself to a complete planning of the year for separate and distinct campaigns on different applications, timed at the proper season and aimed at the right section of the market. These plans continue from year to year, with revision, to include new and drop old applications as markets develop and become saturated. They also permit close supervision and control of the entire promotional effort and insure continuous annual attacks on the most desirable fields.

Samples of action

I would like to call your attention to the natural and easy steps of reasoning from fundamental selling and market conditions which bring the consideration of the problem down to a particular type of organization and to a method of sales attack ideally suited to that type of organization.

Early in 1932 the Philadelphia Electric Company decided that this method of sales attack would be utilized to promote new business during the year, without in any way interfering with the regular sales effort of the salesmen. The service division of the industrial sales department, through its promotional group, selected small stores and restaurants as the air-conditioning field most susceptible to attack. Manufacturers with whom the question of co-operation in a plan of this kind had been discussed for more than a year and a half agreed to co-operate in the expense of the advertising campaign and to co-ordinate their sales efforts with ours. A mailing list was prepared by the Philadelphia Electric Company covering the best prospects in the field, totaling approximately 350 small stores and 225 restaurants. Direct-by-mail advertising matter was prepared by the Philadelphia Electric Company concentrated entirely on

selling the idea of air conditioning, using pictures and "satisfied-user" letters from customers to incorporate in the broadside. The program developed was as follows:

1. Mailing of first piece.
2. One week later, mailing of the second piece, at which time routed calls were assigned to the utility salesmen to make within a specified length of time in addition to their regular work. The salesman was instructed to make one call, developing the prospect to the point where he indicated his interest by asking for a dollars and cents proposition. Such concerns were turned in as active prospects and released to the co-operating manufacturers' representatives for contact and sale of equipment, during which time the third mailing piece was sent out. Close contact with the work of the manufacturers was continued through the promotional group so as to aid them in making maximum effective use of the prospects provided.

A return postal card was included with the first two pieces of this broadside in order to determine the effectiveness of the direct follow up as compared to ordinary broadcast advertising. Eleven prospects returned these cards, while from the direct calls 47 additional prospects were developed, all of whom asked for a dollars and cents proposition covering the cost of the installation. One restaurant and one store installed air conditioning as a result of this single campaign, and the remaining prospects, while unsold, are in the hands of the manufacturers for continued development.

We have felt very much pleased with the results of this campaign in a depression year when money available for the installation of equipment as expensive as air conditioning is scarce everywhere. While I do not believe the maximum effect of sales campaigns of this character can be expected on the first attempt, the cumulative effect of a repetition of such campaigns over a period of several years cannot help but have a very definite effect on building up this market. The cost of the advertising over all was $420 for the store campaign and $460 for the restaurant campaign. Two manufacturers co-operated and the expense was divided one-third each to the manufacturers and the utility.

This campaign was followed by a similar campaign covering steam sales in the central section of the city, using the same personnel, and this, in turn, was followed by a small unit industrial heating campaign, using the same sales personnel and covering the entire territory. Owing to the small investment necessary in this equipment and the ease of installation and flexibility of application, this industrial heating campaign was peculiarly adapted to business conditions as they obtained in 1932. From this campaign we obtained an additional load of nearly 500 kw. and have now under active negotiation by the manufacturers as much more prospective load.

During 1932 the industrial sales department of the Philadelphia Electric Company contracted for more than $1,000,000 worth of electricity, gas and steam. Of this business 446 kw. of demand was in air conditioning and 1,111 kw. of demand was in industrial heating. Our total load in air conditioning now amounts to 8,650 kw. of demand and 17,724,000 kw.-hr. annual consumption, and in industrial heating to 31,537 kw. of demand and 78,500,000 kw.-hr. annual consumption. We do not believe 1932 would have been as successful as it was if it had not been for our organization and sales methods.

In 1933 the air-conditioning campaign on restaurants and stores will be repeated, with the addition of a mailing list of approximately 600 industrial customers. This campaign will be followed by a steam campaign in the central section of Philadelphia and an industrial heating campaign in the entire territory outside of the central district. Following this, in the fall, an industrial campaign on air conditioning for humidification and an industrial lighting campaign will be released and, at the same time, a campaign for the sale of steam-control equipment to existing customers will be released in the central district of the city.

These campaigns will each be carried on by the same sales personnel in addition to their regular work, backed up by the engineering work of the service division, with the work systematized as to routing of calls, timing and promotional information by the promotional group of the service division.

In conclusion I want to again call attention to the flexibility and ease of sales control which are obviously inherent in this method. A consolidation attack on any market can be made choosing the groups most susceptible to sale. In this way you can work down through the market, using previous sales to help you as the sales resistance increases. Upon saturation of any group your force can be thrown immediately as a sales unit upon another part of the market. Certainly such a method will result in more rapid selling.

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Why Electric Refrigeration Appeals to Food Merchant

Two hundred electrically-operated food refrigerating sets, ranging in size from 2 hp. to 20 hp., are used by the Grand Union Company, New York, according to Lester E. Kelley,* who says: "Installation of such equipment is never overlooked when contemplating the opening of a combination food and meat market, for we know that without this equipment the market cannot be successfully operated."

Citing reasons why this company places such importance on refrigerating equipment, Mr. Kelley said:

The modern food market faces the double problem of keeping its merchandise in prime condition and attractively displayed while practicing every economy that will reduce costs in buying, storage, display and handling of a wide variety of products. Mechanical refrigeration, when the equipment for producing it is properly designed and correctly installed to meet the conditions peculiar to each installation, enables a merchant to solve this double problem successfully.

A merchant's trade is governed, for one thing, by the number and variety of items he carries in stock. Users of mechanical refrigeration have found that through their ability to control temperatures they have been able to increase their stocks of perishables with a resultant increase in trade.

In the daily operation of a food market the constant, ever-present bugaboo is spoilage. It is one of the greatest liabilities present in the handling and merchandising of foods. One of the problems of food markets is to gage the day-to-day demands of the trade in order that a sufficient variety and quantity of salable merchandise is on hand for all sales opportunities and at the same time safeguard against overstocking and suffering a loss through spoilage or by trimming meat that has become unmarketable. Mechanical refrigeration, properly installed, reduces such losses to a minimum.

Another way in which a merchant can increase profits through the use of mechanical refrigeration is taking advantage of special

**From address before sales conference of Pennsylvania Electric Association.*

offers from his suppliers, holding the goods for a few days, and then securing a material increase over and above normal profit.

Saving of time and comparative lack of attention are two features of mechanical refrigeration that go far in reimbursing a store owner for his initial outlay. The time ordinarily spent in ordering, cutting, weighing, carrying and stocking ice in the various compartments can now be used by the food merchant in preparing meats, arranging attractive displays, maintaining contact with customers over the phone and, in general, furthering the interests of his business.

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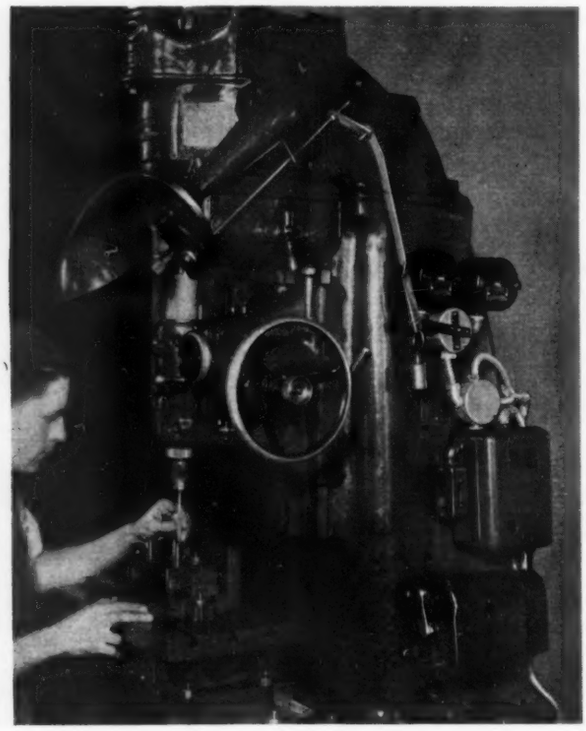
Machine Time and Labor Costs Saved by Meter

By H. K. NOCK
General Electric Company, Schenectady, N. Y.

As a result of a check study made with electric time meters one of the plants of the General Electric Company was able to increase greatly the availability of a jig-boring machine. A request had been made for authorization to purchase the additional machine in tool and die-making work. One machine was in use in this department and the report stated it was in "continuous" use.

Study with time meters showed that, although the present equipment was in use continuously, it was being used as a workbench. Work to be jig-bored was "set up" on the table of the machine. Often a single job required hours for this preliminary work, followed by but a few minutes of actual cutting.

Following the time study, work is now set up at the workman's bench on a plate especially arranged for securing to the jig borer and the machine itself no longer functions as a bench. In another instance use of these electric time meters in the analysis of operating versus idle time of a large battery of screw machines in one of the General Electric plants was so profitable that the devices paid for themselves in four weeks.



Time meters tell actual production time of boring mill

The machines are used for producing a variety of small parts and the operators are paid on a piece-rate basis. In order to determine what part of the operators' time was devoted to actual production and what portion was non-productive, it was found necessary to use some other method than the usual method of relying on memory or estimating by guess. It was believed that overpayment was resulting from the methods previously employed.

The problem was solved by installing a small electric time meter as a permanent part of each machine—67 in all. The cyclometer register shows the total running minutes for the machine to which it is connected.

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READERS' FORUM

Polar Intensity Curves Originated in 1883

To the Editor of the ELECTRICAL WORLD:

In your issue for January 28, 1933, page 132, Edwin S. Oberndorf indicates a polar diagram of luminous intensity in which one and the same curve represents the distribution of luminous intensity as well as that of flux.

I might point out here that this way of representing graphically the light-distribution characteristics of a light source is quite identical to a method indicated as far back as 1883-1884 by Rousseau[1] and again proposed by Gerhardt[2] in 1918.

The method of Rousseau, which is equivalent to Mr. Oberndorf's, is called by him "method of the surface of equal illumination," because a constant illumination would be obtained on elementary surfaces normal to any light ray at distances from the light source proportional, in any ratio, to the radii in the diagram.

As far as I know, some forty different graphical or analytical methods for determining luminous flux, the intensity distribution being given, have been proposed by different authors. In an opuscule published in 1929 I discussed the respective merits and drawbacks of all these different methods. In a previous article[3] I had already published a polar surface flux diagram of my own and, among several others, I had compared this with Gerhardt's diagram, which is now republished by Mr. Oberndorf.

All this may prove once again how difficult it is to find something really new in long-explored fields, as I experienced, too, when after having published the above-mentioned diagram of my own, I discovered it to have been imagined years before by an Italian author.[4]

E. L. J. MATTHEWS.

Eindhoven, Holland.

[1] *Ingénieur-Conseil (Paris), Vol. VI, 1883/1884, page 246.*
[2] *Zeitschrift für Beleuchtungswesen (Berlin), Vol. XXIV, 1918, page 54. Elektrotechnik und Maschinenbau (Vienna), Vol. XXXVI, 1918, page 359. Journal für Gasbeleuchtung und Wasserversorgung (Munich-Berlin), Vol. LXI, 1918, page 361. Elektrotechnische Zeitschrift (Berlin), Vol. XL, 1919, page 92.*
[3] *Revue Générale de l'Electricité (Paris), Vol. XXIV, 1928, page 275.*
[4] *Rosario Dispenza, Rassegna Tecnica (Messina), 1912, No. V.*

Men of the Industry

William McClellan President of Potomac Electric Power

William McClellan has been elected president of the Potomac Electric Power Company, Washington, D. C., to succeed William F. Ham, who was elected chairman of the board of directors. Mr. McClellan also was made a director of

the company. Similar changes were made in the Braddock Light & Power Company, a subsidiary.

Since 1929 Mr. McClellan has been vice-president of the Stone & Webster Engineering Corporation and in that capacity has served as consultant during the last few years for the Potomac utility. A native of Philadelphia and a graduate of the University of Pennsylvania, he obtained his early engineering experience with the Philadelphia Rapid Transit Company from 1900 to 1905 and with the Westinghouse, Church, Kerr & Company from 1905 to 1907. During the succeeding twenty years he was a member of the engineering firms of Campion-McClellan Company, Paine, McClellan & Campion and McClellan & Junkersfeld, serving also as consulting engineer for the New York Public Service Commission from 1911 to 1913 and as dean of the Wharton School of the University of Pennsylvania from 1916 to 1919. His experience has included the operating management of electric power companies as well as construction and other phases of electrical engineering.

In 1925 he was selected by President Coolidge as a member of the Muscle Shoals Commission. Mr. McClellan is a past-president of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers.

Mr. Ham, the retiring president, has been connected with the company for more than 33 years and has occupied the office of president for fifteen years. Under the new plan he will have an opportunity to devote more of his time to the transportation merger and other matters involved in the development of utility service. He will continue as president of Washington Railway & Electric Company and its subsidiary transportation companies.

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S. R. Inch New President of Electric Bond & Share

Sydney R. Inch, who has recently been elected president of the Electric Bond & Share Company (ELECTRICAL WORLD, April 1, page 402), has had wide experience in the operation of public utilities, and since 1912 has been connected with the various operating companies affiliated with Electric Bond & Share. He came to the New York offices of the company in 1924 as a vice-president and in 1931 was made executive vice-president.

Mr. Inch was born in Taunton, England, in 1878, and received his technical education at Finsbury Technical College, London. Before coming to this country in 1900, at the age of 22, he had obtained practical experience in English central-station work at Taunton and in the manufacture of storage bat-

teries with the Lithonode Electric Storage Company of London. Upon his arrival in America he entered the employ of the Montana Power Transmission Company, a predecessor company to the Montana Power Company. He became a citizen of the United States in 1906.

It was as general superintendent of Utah Power & Light Company, with headquarters in Salt Lake City, that he joined the Electric Bond & Share group of properties 21 years ago. After a period of five years he was elected to the executive position of vice-president and general manager of the Utah company, an office he occupied until going to New York in 1924. Mr. Inch is a member of the American Institute of Electrical Engineers.

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R. GILMAN SMITH has been appointed assistant vice-president of the North American Company and C. E. NEIL and EDWARD M. THIERRY have been named assistants to the president. Mr. Smith was formerly statistician. Mr. Neil continues in charge of rate research and Mr. Thierry in charge of advertising.

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FRANK D. COMERFORD, president of the New England Power Association, was also named chairman of the board of directors of the association at an organization meeting of the directors held this week. As chairman Mr. Comerford succeeds the late Charles Leavitt Edgar. Since Mr. Edgar's death, a year ago, Mr. Comerford has been acting chairman of the board.

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DAVID W. BEAMAN, formerly manager of the New Bedford Gas & Electric Light Company, New Bedford, Mass., has been elected president of that company to succeed Oliver Prescott, who has become chairman of the board of directors, a new office. Mr. Beaman is widely known in New England electrical circles. W. E. MANGE, son of the president of the Associated Gas & Electric Association, was elected general manager of the company. He has been assistant manager since 1930.

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OBITUARY

Frank T. Hulswit

Frank T. Hulswit, formerly president of the United Light & Power Company and more recently of the American Commonwealths Power Corporation, died April 2 in Bellevue Hospital, New York, of injuries which he suffered when he fell from a window of his apartment in the Hotel Astor. Mr. Hulswit was one of the most spectacular figures in the public utility field. As president of the United Light & Power Company, a $575,000,000 enterprise, he held a dominant position in the electric light and power industry, which he lost in 1926 after the collapse of a Wall Street pool in the company's shares which he had directed. Staging a comeback, he organized the American Commonwealths Power Corporation within a year, launching an expansion program that in 1929 had carried its influence from New England to the South and had also spread to Canada. Through this company he managed to obtain an interest in United Light again, returning to the board in 1931. At the end of that year receivers were appointed for American Commonwealths

and Mr. Hulswit resigned the presidency, retaining an interest in it through the presidency of the American Corporation. Early last year he also resigned from the directorate of United Light. Mr. Hulswit was born in Grand Rapids, Mich., 58 years ago. He entered upon his career in a subordinate position with the Michigan Trust Company and after obtaining some experience in selling bonds established a bond business of his own. Gradually acquiring utility companies in the Middle West, in 1910 with Mr. Schaddelee he formed the United Light & Railways Company, which expanded and became the United Light & Power Company, the presidency of which he occupied for sixteen years.

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CLARENCE L. YORK, head of the safety department of the General Electric Company, died at his home in Schenectady, N. Y., March 9, after an illness of about seven weeks. Mr. York had been identified with the General Electric Company for 35 years and had served as a member of the Industrial Board of New York State.

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SIR EDWARD MANVILLE, electrical pioneer, consulting engineer and industrialist, died in London recently, as a result of a long illness. Sir Edward was born in 1862 and was educated at the University College School, London, and at various technical institutions. A vast technical knowledge was the foundation of his successful professional career as an electrical and mechanical engineer and paved the way to his occupation of important positions in the work of commerce and engineering. These included the chairmanship of the Daimler Company, the B.S.A. Company, the presidential chair of the British Chamber of Commerce and of the Society of Motor Manufacturers and Traders, as well as the vice-chairmanship of the Federation of British industries.

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DR. WILLIAM C. UNWIN, distinguished British engineer, who helped in the hydro-electric installation for the utilization of power at Niagara Falls, died March 17, in London, at the age of 94. He was secretary of the international commission for the utilization of the Niagara and was retained as one of the consulting engineers on that project. Dr. Unwin was the first recipient of the Kelvin medal, one of the highest honors within the attainment of the engineering profession, the presentation having been made to him in 1921 by Arthur James Balfour. From 1884 to 1904 he was professor of engineering at the Central Technical College of the Guilds of London. He served as president of the Institute of Civil Engineers in 1911 and of the Institute of Mechanical Engineers, 1915-1916.

New Equipment Available

Varidrive Motor Involves Variable Speed Differential

"Varidrive" motors consisting of a simple squirrel-cage motor and a variable speed differential which comprises dual disks coupled with the U. S. "Varibelt" are announced by the U. S. Electrical Manufacturing Company, Los Angeles, Cal. The differential disks, which are called "Varidiscs," reciprocally expand and contract for higher and lower speeds, transmitting power through the Varibelt to the take-off shaft. Because of its few moving parts, varidrive is reliable, durable and will operate continuously trouble-free, it is claimed.

Some of the features are: quick change to any speed while driven machine is in operation, speed variations as fine as 1 r.p.m. through microspeed adjustment; arranged with local or remote control for speed changes without stopping; smooth running, shockless transmission, sudden load shocks relieved, absorbed, etc.

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COPES THRUSTOR-OPERATED CONTROL VALVE, for centralized remote control of flows of gases or liquids under pressure, is announced by the Northern Equipment Company, Erie, Pa. The thrustor is a self-contained power unit, consisting of a motor controlling an improved hydraulic cylinder. It applies a straight-line, constant-pressure thrust on the valve lever, to open or close the valve, depending on the service requirements. The thrustor operates in one direction only, the weight acting to return it to the original position when the electrical circuit is broken.

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AIRPORT TRAFFIC SIGNAL which provides a simple yet certain method for ground control of traffic at airports is announced by the Westinghouse Electric & Manufacturing Company. The signal's unusually high candlepower and wide beam spread make it legible from any part of the landing area for all taxi movements and takeoffs.

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Improved Boiler Tubing

Electric resistance-welded boiler tubes, known as "Electrunite," have been announced by Steel & Tubes, Inc., Cleveland, Ohio. The tubing is formed from strip steel continuously, the strip being passed through a series of forming rolls. The round butted tube thus formed then passes under revolving wheel-like copper electrodes where current travels from electrode to electrode through the gutted seam of the tube. At the same time pressure is applied, which, together with the heat which is below the fusion temperature and which is confined to an area no larger than a pinhead, completes the weld. The tubing is later normalized and fully tested in accordance with A.S.M.E. specifications.

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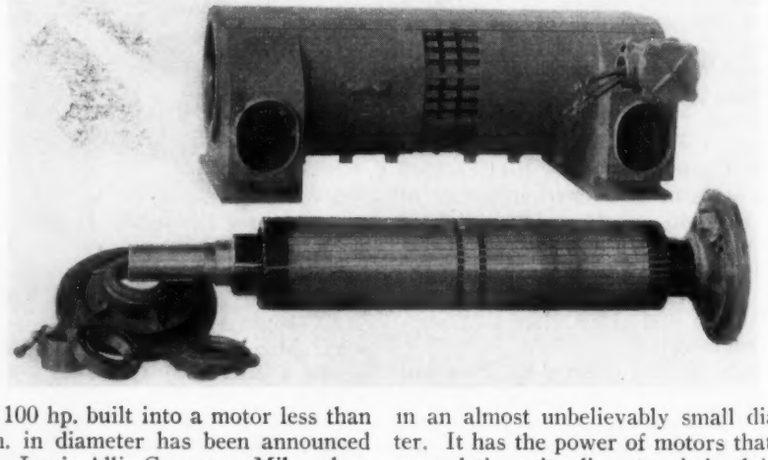
100-Hp. Motor of Small Diameter



Full 100 hp. built into a motor less than 12 in. in diameter has been announced by the Louis Allis Company, Milwaukee, Wis.

In order to meet the demands of the ever-changing conditions of modern industry, this motor has been developed to supply the maximum amount of power in an almost unbelievably small diameter. It has the power of motors that are several times its diameter, it is claimed, and is suitable for direct-mounted grinding wheels, saws, cutter-heads, etc., where the diameter and peripheral speed of the cutting tool must be held to a minimum.